





A
TREATISE
ON
SURGICAL ANATOMY;
OR THE
ANATOMY OF REGIONS,
CONSIDERED IN ITS RELATIONS WITH SURGERY.

ILLUSTRATED BY PLATES,
REPRESENTING
THE PRINCIPAL REGIONS OF THE BODY.

BY
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IN TWO VOLUMES.

TRANSLATED FROM THE FRENCH, WITH ADDITIONAL NOTES, BY

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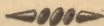
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Several important works having been received since the first volume of this Treatise was issued, it is proper to mention them: thus, the superb plates of Tiedemann, upon the arteries,* have afforded me numerous examples of anatomical varieties in the arterial system. The fifth edition of the Dictionary of S. Cooper, published in London in July, 1825, and which was not then known at Paris, has enabled me to make an advantageous use of certain discoveries which have recently been made in Germany, and in the United States. I there perceive, among other rare and curious facts, that Doctor Prieger has completely and successfully removed the parotid gland; but, on the other hand, it is with regret that I also find, that S. Cooper, so familiar with French medical literature, has not taken notice of the similar operation performed by Bécclard, two years previous. I have likewise observed, in the appendix to the American edition of this dictionary, that Professor Valentine Mott has thrice removed one of the halves of the lower jaw, at the articulation, and that in one case this operation was attended with complete success.

I regret that I was not able to procure sooner the Elements of Surgery, by Doctor Dorsey of Philadelphia; for in it we find the proof that, in the United States of America, the sciences are cultivated with ardour; that anatomy, in spite of numerous obstacles, is there making rapid progress, and that the surgery of this country will soon rival that of the most enlightened nations of the old world. Thus, the celebrated Mott has performed, and frequently one of the first, the greatest surgical operations, such as the ligature of the arteria innominata, of the

* Tabulæ Arteriarum, &c.

external iliac, the amputation of the thigh at the joint, &c.; and Professor Physick, of Philadelphia, has invented several operatory processes, whilst other *savans* have adopted them at London and at Paris.*

There is another work which I have not sufficiently consulted, notwithstanding it contains important anatomical and surgical remarks; it is the *Clinique Chirurgicale* of the learned Professor Delpech of Montpellier. I might say as much of the publication of M. Lallemand, professor in the same school, upon the urethra and its diseases. In relation to lithotomy, catheterism, and the anatomy which concerns the urethra and perineum, I have made use of the valuable researches which M. Leroy (d'Étiolle) has just published upon the different methods of breaking the stone in the bladder, as well as of a memoir upon the bilateral lithotomy which M. Ollivier has been pleased to communicate to me whilst it was in the press; an operation which has been attended with such satisfactory results in the hands of M. Dupuytren.

In relating the primary opinions published on the anatomy of regions, I omitted speaking of Winslow, notwithstanding the third volume of his *Exposition Anatomique* contains under the title of *Traité sommaire des parties, etc.*, a small abridgement in which those who find plagiarism every where, might go seek the source of the opinions of Desault, of the sketch of M. Boyer, and of the lectures of Béchard. There at least might be discovered without difficulty the origin of a book entirely forgotten, but which, nevertheless, is the most remarkable which we possess on surgical anatomy and the anatomy of regions:

* Although M. Velpeau speaks in very high terms of American Surgery, yet it would seem as if he here implied that Dr. Physick is merely the inventor of certain operatory processes, which have been introduced into practice by others. We are therefore induced to think, notwithstanding he previously alludes to Dorsey's Surgery, that he has not given to this work an attentive perusal; otherwise he would there have found, that Dr. Physick was the first to put successfully into practice his admirable invention for the cure of Artificial Anus, an operation which anticipated that which M. Dupuytren has adopted for the removal of the same malady, and which, if not equal to, is at least founded upon equally as scientific principles as that of the latter celebrated surgeon. (See page 201 of this Treatise.) To this we might add the introducing of a seton between the un-united extremities of a fractured bone entering into the formation of an artificial joint, which was first proposed and first successfully executed by Dr. Physick; but it is needless for us to mention here the number and ingenuity of Dr. Physick's inventions in surgery, or the skilful manner in which he has applied them, and the beneficial effects which have resulted from their application, as they are, doubtless, familiar to every American Surgeon.

I mean the *memoires* of *Vincent Malacarne*.* It is somewhat singular that this work, the product of the pen of one of the most celebrated modern anatomists of Italy, has not been noticed. This species of oblivion is doubtless to be attributed to the plan which the author adopted, who has not taken sufficient trouble to establish precise limits for the different regions which he successively passes in review; to his having merely enumerated the parts without describing them, or saying any thing of their relations, peculiarities of form or position; and, especially, to his surgical remarks, which are, for the most part, only very common-place notions, and the most elementary of this science, being almost entirely unconnected with the anatomical exposition which precedes them. Nevertheless, this book does not deserve the profound oblivion into which it has fallen: it certainly should rank far above that of Rosenthal.

The plan of my work having now been for three months before the public, I have received the advice which they have given me, and the observations they have made, with gratitude; I have even solicited criticism, in order that I might profit by it in the composition of the present volume; and I must say, that thus far they have treated me with a degree of benevolence to which I certainly had no right to pretend. By this, however, I do not mean that no faults have been found with it; indeed there are several which I think should be mentioned here.

1st. Some persons, whilst they praise the general distribution of the work, have objected that, in order to understand it, a knowledge of anatomy is necessary, and consequently, that it is not suited to students commencing the study of medicine. To this I reply that my intention was not to take the place of other treatises on anatomy, nor to make a book for those who have not yet acquired some knowledge of the organization of man; but that the surgeon might, by studying successively the different sections which I have established, obtain as exact and perhaps more positive information than by any other method.

2nd. Others, on the contrary, consider that I have erred in describing all the parts of the body, because a great number of them present but little surgical interest. This censure does not appear to me to be just. Indeed it was either necessary to make a complete treatise, or none at all. Now, in the first case, all the regions must necessarily

* Ricordi della anatomia chirurgica spettanti al capo e al collo,—al tronco,—alle braccia e alle gambe, etc. Padova 1801—1802.

be passed in review, the one after the other ; and besides, is there one of them upon which we may not be called to perform some operations ?

3d. Some have found the work too voluminous ; and one asserts that I have dwelt too long upon surgical considerations, or pathological observations, whilst another says that I have insisted too much upon anatomical detail. Such censures annul one another, and I must confess that they have surprised me, in every way. In the first place, I dare affirm that it is impossible to treat the same subject in a single volume, without doing it superficially ; unless we imitate those who make it their business to transform every good book into simple manuals ; as if every one was endowed like Hippocrates, Boerhaave, Stoll, with the capability of reducing any part of medicine whatsoever to a few aphoristic sentences ! Has not Burns published an entire volume upon the head and neck only ? Those who read my production with some attention will be be convinced, if I do not deceive myself, that I have not dwelt upon anatomical descriptions, except when it became necessary in order to explain certain methods of operation, some morbid phenomena, or when the parts did not seem to have been presented under their proper aspect. On the other hand, I beg leave to remark that the principal object of this work is to illustrate the practice of operations ; consequently, I could not dispense with discussing the relative value of operatory processes founded upon the anatomical disposition of the parts.

4th. I am also censured for not having described more fully the external configuration, or picturesque anatomy. I admit that it would have been possible to have entered more into detail on this subject ; but writing for surgeons rather than for painters, I was apprehensive that I had already gone too far in this respect. It would have been very easy, however, to have filled up this void, as it is the most simple part of the subject.

5th. There are those who have supposed that the regions might have been better designated from the presence of some important organ, than by arbitrary lines. Thus, they would have preferred *sternomastoidean*, *carotidean*, *laryngeal*, *tracheal*, *lingual*, *tonsillar*, &c. regions. This was the method which I attempted first : it would have exacted much less labour ; but I soon perceived that it would render the objects extremely vague, and that all precision would have been impossible. Besides, it would only have been tracing the steps of *Winslow* and of *Malacarne*, and would have produced a work quite as useless as that of the latter author.

Furthermore, this plan seems to me to deviate too much from the rigid accuracy which ought to characterize surgical anatomy, for any one to adopt it, and I may therefore dispense with exposing the defects of it.

Finally, all these objections relate to the method only, and I observe with satisfaction that none have as yet been raised against the correctness of the descriptions or the judiciousness of the practical applications, which must essentially constitute the fundamental part of the work.

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SURGICAL ANATOMY.

CHAPTER V.

OF THE ABDOMEN.

By the term abdomen we mean that large part of the trunk which is bounded, superiorly, by the thorax, inferiorly, by the pelvis, and posteriorly by the lumbar portion of the spine, which is also comprised in it; it constitutes the belly properly so called, or the lower belly of the ancients, and includes almost the whole of the digestive organs in its cavity.

In the adult, its surface presents greater breadth below than above, especially in females, which is owing to the enlarged capacity of their pelvis, and the compression of the thorax by dress.

In the fœtus, and in childhood, we observe an inverse disposition, that is to say, that then, in consequence of the narrowness of the pelvis, the shortness of the sternum, and the elevation of the ribs, the abdomen appears to be proportionately much broader superiorly.

The anterior superficial dimensions of the abdomen are much more considerable than the posterior, because, on the one hand, the pelvis and thorax are extensively excavated in the anterior third of their circumference; and, on the other, because the planes of these two cavities are inclined in opposite directions;

whilst posteriorly, they tend to approximate each other. This disproportion, however, does not exist in the same relations inferiorly; the belly is indeed prolonged in the same manner downwards and forwards; but upwards, the diaphragm permits the viscera to ascend very far posteriorly; so that the abdominal cavity would be pretty exactly limited by a circular line, the two halves of which would terminate, anteriorly upon the base of the xiphoid appendix, and posteriorly upon the spinous process of the tenth dorsal vertebra.

Anteriorly, the abdomen is likewise remarkable with respect to the varieties which its volume presents, and the points at which it is most prominent. In the fœtus, it is very large, and projects most at the superior part and on the right side, in consequence of the presence of the liver; in infancy, it is still very large, on account of the chest and pelvis, which do not acquire a certain capacity until after puberty; but then the protuberance is in the middle, or begins to be more strongly marked towards the inferior part. In women, the belly is generally more developed than in men, especially in those who have borne several children. Until the adult age, the volume of the abdomen is almost uniformly proportionate to that of the digestive organs; whilst, at a later period, it is generally augmented by the accumulation of fat in the peritoneal duplicatures or subcutaneous tissue.

There is in this part of the trunk a moveable and extensible portion, composed of soft tissues, and a solid and fixed portion which includes the skeleton. The first constitutes the abdominal parietes properly so called, is of much greater importance in surgery than the second, and merits, in some of its points, very particular attention. Its figure, supposing it separated from the body and flattened out, is that of a rhombus or Malta cross unequally excavated; its lateral angles are prolonged backwards between the ribs and the iliac crests, in order to become attached to the vertebral column; superiorly, it is connected to the cartilages of the false ribs and sternal appendage, filling up the great anterior notch of the base of the thorax, and inferiorly it is fixed to the whole length of the crista of the ilium and Poupert's ligament, and completely fills the pubic notch of the pelvis major. Its surface presents in a thin but muscular adult subject.

1st, superiorly, upon the median line, an excavation which terminates the central depression of the sternal region, constituting the pit of the stomach or *scrobiculus cordis*: 2d, lower down, a superficial furrow, a continuation of the preceding *fossette*, which terminates just above the pubis; 3d, quite near the pubis, the commencement of that prominence which is called the *pecten* or *mons veneris*; 4th, on each side of the median line and parallel to the axis of the body, a prominence, intersected from space to space by transverse depressions, and which corresponds to the recti muscles; 5th, still more laterally, two broad depressions, which are at first superficial, but become deeper as they approximate the spine.

The constituent parts of this portion of the abdomen, are,

(a) The *Skin*, which is generally pretty thin and presents particular characters in each region.

(b) A *Subcutaneous Layer*, composed of numerous lamellæ, enveloping the ramifications of the superficial epigastric artery, twigs of the lumbar, circumflex iliac, intercostal, and internal mammary arteries and veins, some nervous filaments and adipose vesicles. The deep sheets of this layer constitute the *fascia superficialis* pointed out by Camper, and recently much better described by Sir Astley Cooper and M. J. Cloquet. We are of opinion that this fascia is not peculiar to the abdomen; indeed, we find a layer exactly similar to it under the skin of the other parts of the body, with this difference, however, that in the latter it less frequently assumes the fibrous character and is generally thinner than upon the abdomen; but this appears to depend altogether upon the greater abundance of the cellular tissue here, and its being spread out like a sheet over an extensive surface; also, to the more frequent compression of the lamellæ of this tissue against each other, between the aponeuroses and skin, in consequence of the frequent variation in the volume of the belly; in the extremities, temples, etc., for example, the subcutaneous stratum almost always presents a disposition analogous to that of the abdominal fascia superficialis; besides, it is well known to anatomists, that in young or fat subjects, this lamina is scarcely distinct as an aponeurosis; that, on the contrary, it is thick and very easily distinguished in thin and in old persons; that it is continuous with the subcutaneous cellular tissue of the thorax,

of the circumference of the pelvis, and of the inferior extremities. Hence the superficial fascia is nothing more than condensed cellular tissue, the laminæ of which being more or less firmly applied to each other, at length assume an aponeurotic structure in many individuals. This is effectually proved upon the dead subject by maceration, which readily causes it to disappear, or transforms it into a spongy and purely cellular layer; and, upon the living, the same thing occurs where the fat is redundant or serous infiltrations exist. Finally, it is pretty evident that the cellular tissue is the formative element of all the aponeuroses, and that the fibrous tissue is only one transformation of it; that the subcutaneous layer, diversely modified, is another, and that, in all its portions, it is possible to follow it, and see it gradually assuming fibrous characters, and becoming continuous with aponeuroses, ligaments, capsules, or penetrating down to the bones and blending with the periosteum. Upon the abdomen, for example, the fascia superficialis seems to originate from the median line; it is fixed to this line by numerous, dense, compact, and almost unyielding filaments, which seem to be detached from the aponeurosis in order to attach themselves to the skin, on the one hand, becoming rarified on the other, and expanding in the form of a simple cellular web upon the sides.

(c) *Ten Muscles*: the two pyramidales arising from the pubes, and prolonged by means of a slender cord, almost to the umbilicus; the two recti muscles, descending from the chest to the pubis, enclosed in a very strong fibrous sheath, and serving, in a special manner, to maintain the thorax and anterior part of the pelvis in their proper relations; the external oblique muscles, passing obliquely downwards and inwards, from the last seven ribs to the spine of the ilium; the internal oblique, which ascend from the crest of the ilium and from the groove in the crural arch to the cartilaginous margins of the false ribs; lastly, the transversales muscles, originating from the apex of the spinous processes, the root and extremity of the transverse processes of the lumbar vertebræ, by three fibrous sheets, in order to terminate upon the external border of the abdominal aponeurosis, being also attached to the internal surface of all the false ribs, where their digitations intersect those of the diaphragm. It should be observed that the oblique and transverse muscles form three

regular superstrata, which are only separated from each other by a very delicate lamellated cellular tissue, and as the fibres of the most superficial stratum run downwards and inwards, those of the middle, downwards and backwards, whilst the direction of the internal is transverse, they afford a much greater degree of resistance than if their fibres were parallel.

(d) An *Aponeurosis*, very strong and very complicated, into the external margin of which the broad muscles just noticed are inserted; the external oblique furnishing the first layer, the principal fibres of which follow the direction of those of the muscle. It is this sheet which forms Poupart's ligament; it runs single as far as the external edge of the rectus muscle, where it unites with a lamina derived from the internal oblique, the aponeurosis of which is at first single also, but splits on reaching the rectus, so that its anterior sheet immediately unites with the posterior surface of the preceding, and passes with it before this muscle, in order to be inserted into the median line, whilst the posterior becomes blended with the aponeurosis of the transverse, and with the latter, which is very strong, passes behind the rectus muscle to the linea alba, where it rejoins the anterior fibrous layer. It must be observed, however, that this arrangement does not exist throughout the whole length of the abdominal paries, for the aponeurosis of the transverse ceases to be distinct behind the inferior fifth portion of the rectus muscle, which is there separated from the peritoneum by cellular tissue only; but we will treat more fully of this when we come to the hypogastrium. From what has been said it follows, that the thick fascia of the belly is at first composed of three layers, one for each muscle; but that afterwards, the middle aponeurosis, or that of the internal oblique separates into two laminæ, which become blended with that of the external oblique before, and of the transversalis behind: so that the rectus is enveloped by two sheets only, on the internal edge of which they are again confounded. At the linea alba then all these laminæ terminate, so that this line forms a species of fibrous cord, or tendon with parallel fibres, extending from the ensiform cartilage to the symphysis pubis, and which may be considered as a common centre of insertion for all the fibrous elements of the abdomen; a centre which is continuous superiorly with the aponeurotic layers, between which the sternum is placed; in-

feriorly, with the fibrous tissue which exists at the fore part of the pelvis, and consequently with the aponeuroses of the thigh. As this tendon is more or less tensely stretched between its two principal points of insertion, it serves to limit their separation, and, for this reason, its transverse division would not be void of danger. The fibres of this tendinous cord being for the most part parallel to the axis of the body, it follows that in those who have protuberant bellies, as dropsical persons, or pregnant women, for example, they separate, are drawn asunder, and sometimes admit the escape of the viscera, thus forming complete herniæ, which, when very large, we call *éventrations*, and which are characterized by not being subject to strangulation, because the sac generally preserves the form of a funnel, that is to say, that it remains larger at its mouth than at its fundus.

The linea alba, however, is not the only part which gives way under over-distension; all the aponeuroses also become attenuated, and many small apertures naturally existing in them enlarge, permitting the protrusion of the viscera; the recti muscles are flattened out and separated from each other, drawing the epigastric artery out of its course, and exposing it to injury should the operation of paracentesis abdominis be performed according to the ancient method.

(e) *Some arterial, venous and lymphatic vessels.* The former are the epigastric and circumflex iliac arteries, derived from the external iliac; the lumbar branches, the terminations of some of the intercostals and of the internal mammary. The veins accompany the arteries, and the lymphatics are divided into supra and sub-umbilical.

(f) *Some Nerves*, which are principally derived from the lumbar plexus, to which we must add some ramifications from the intercostal branches. But all these parts, collectively and particularly, present characters so diversified in different points of the abdomen, that anatomists have long felt the necessity of establishing a certain number of regions in this part of the body.

We will retain here the general division which is usually made of the parietes of the abdomen, and will therefore examine successively the three *zones*, designated by the names *epigastric*, *meso-gastric*, and *hypogastric*. The first is bounded, superiorly, by a circular line drawn from the spinous process of the tenth dor-

sal vertebra to the base of the ensiform cartilage, which we will call the *supra-epigastric line*; inferiorly, by another circle, passing from the last dorsal vertebra under the margin of the ribs, so as to cross transversely about two inches above the umbilicus: we will name this line *supra-umbilical*. The second is separated from the third by a line which would unite the two anterior and superior iliac spines, and would afterwards follow the crest of these bones, in order to terminate behind the first portion of the sacrum: this we will denominate *sub-umbilical*. Each of these segments of the abdomen are naturally subdivided into four portions by the *clavi* and *scapulo-coxal* lines. The anterior of these portions will retain the names first mentioned. Of the posterior, the lumbar region alone appertains to the belly; the others enter into the dorsal and sacral regions. The lateral portions are the *hypochondria* and *flanks*.

Abdominal Parietes, or Containing Parts.

ART. I. OF THE THORACO-EPIGASTRIC ZONE.

This portion of the abdomen comprises the epigastric and hypochondriac regions; its vertical dimensions are much more extensive before than behind, because the circle which bounds it below, in its course along the inferior margin of the last rib, approximates the supra-epigastric line considerably.

Sect. I. Epigastric Region.

This region is circumscribed by the clavi-coxal, supra-epigastric and sub-umbilical lines, so that it includes a portion of the hypochondria, and, strictly speaking, it should be limited upon the sides, by the margin of the costal cartilages, as is represented in Plate I, fig. 1. Thus considered, it represents a triangle, with its base downwards. Upon its surface, and in the middle, we observe the *scrobiculus cordis*, surmounted by a relieve corresponding to the cartilage of the sternum, and upon the sides, the border of a species of arch formed by the anterior notch of the thorax. The recti muscles are seldom so prominent here as to be distinguished externally. In dropping a line from the base of

the xiphoid appendix upon the middle of the supra-umbilical line, we find about five inches and a half; if we carry this same line to the point of intersection of the clavi-coxal and supra-umbilical lines, we will have from six to six and a half inches.

CONSTITUENT PARTS.

1. *The Skin.*

The skin of the epigastric region does not possess any very striking characters which are peculiar to it; it is delicate and but little coloured; in the adult male it is sometimes covered with hair upon the median line; it is freely supplied with sebaceous follicles and possesses great sensibility. From its sympathetic relations with the lungs and stomach, it is an eligible situation for the application of Autenreith's rubefacient ointment, in whooping cough and some other diseases. In females it is whiter, and its surface smooth and polished.

II. *The Subcutaneous Layer, or Fascia Superficialis.*

This is merely a thin cellular layer in children, but of considerable thickness in adults and emaciated persons. In polysarcia, it does not form so thick a fatty mass as in the inferior regions. Its lamellæ are more compact upon the median line than upon the sides, and adipose cells are more abundant in the latter situation; therefore, in anasarctous or in fat persons, the median depression of the epigastrium is strongly marked, whilst it scarcely exists under opposite circumstances. This layer is equally adherent to the aponeuroses and skin; it is directly continuous with the adipo-cellular layer of the sternal region, does not contain any important vessels or nerves, and may be the seat of adipose tumours, chronic and phlegmonous abscesses, which are very liable to burrow extensively, but which seldom extend towards the cavity of the abdomen, on account of the very firm resistance afforded by the muscles and aponeuroses.

III. *The Aponeurosis.*

The lamina of the external oblique does not unite with that of the transversalis until it reaches the linea alba ; its fibres are so arranged as to form a complete lace-work. There are but a very small number of vascular apertures in it, and it is very rare that fatty prolongations escape through them. We find but a very small portion of the aponeurosis of the internal oblique in this region : so also with that of the transversalis, which is triangular and entirely concealed by the recti muscles, or nearly so ; which is owing to the fleshy fibres which furnish it, arising from the costal cartilages, approximating more and more towards the median line in proportion as we ascend towards the summit of the region : whence it follows that the fibrous sheet of the transversalis can only be distinguished near its junction with the linea alba, except at the lowest part of the region, where it is seen by the side of the rectus muscle. The middle tendinous cord is broader, but thinner, than in the regions below this ; its fibres evidently intersect each other, and seem to demonstrate that those of the aponeurosis of one side cross the median line, in order to be inserted into the opposite side ; they are less easily drawn asunder here than elsewhere, although they do not afford so great resistance : this circumstance depends upon their being less exposed to those violent tractions which the other points of the abdomen sometimes experience. It is only at the termination of pregnancy, for example, and in the highest stages of ascites, that the epigastrium participates in the general abdominal distention. On the other hand, tumefaction of the liver, or of some other viscus, or an encysted dropsy, might act more forcibly upon this point than upon the others. Vomiting, or any effort whatsoever, are also capable of producing a separation of the fibres of the linea alba. It is necessary to observe, however, that this separation more frequently occurs on one side of the fibrous cord than upon the median line itself, especially in the vicinity of the xiphoid appendage, because there, the aponeurosis being formed almost entirely by the sheet of the external oblique can offer but a very feeble resistance. Be this as it may, when such separations do occur, it is evident that the subjects of them are very

much exposed to epigastric herniæ, and in such cases it is by no means surprising, as Camerarius, Renaulme, Garengeot, Gunz, Pipelet, &c., have affirmed, that the stomach should be engaged in the aperture; and notwithstanding tumours of a very different character may have been mistaken for herniæ of the stomach, still we should not with Richter deny the possibility of their occurrence, because they have not as yet been demonstrated by autopsic investigation. If we attentively examine the cases detailed by Pipelet, we will scarcely have any doubts upon this subject. When these tumours approximate a little nearer the inferior part of the epigastrium they generally contain a portion of the transverse colon, which may then become strangulated, or at least produce serious consequences. Lapeyronie has recorded a very interesting case of this kind, which was proved by examination after death. Between the peritoneum and the muscles, the peritoneum and the aponeurosis, and between the two sheets of the latter we find some cellular tissue and adipose lobules; several of these lobules are connected to the peritoneum by a sort of pedicle, and the different fibrous layers are perforated in many places for the transmission of blood-vessels. It not unfrequently happens that some of these adipose bodies pass through one of the apertures, enlarge, and project under the skin, forming what are called "*fatty herniæ*;" these may afterwards draw along with them a pouch of peritoneum, into which some of the abdominal viscera may insinuate themselves, and thus give rise to symptoms of a more or less alarming nature. We have met with these tumours in the epigastric region, upon the dead body, and have also remarked them several times upon the living. They are characterized by being indolent and irreducible, by their being seldom attended with digestive derangement, unless some of the abdominal viscera are contained within them, and by undergoing no change of volume from position, etc. They are most frequently observed near the median line or at the summit of the epigastrium, on account of the tenuity and disposition of the aponeuroses in these situations; we have met with them, however, on the outer side of the recti muscles, where the fibrous laminæ equally present some vascular apertures.

IV. *The Muscles.*

In the epigastric region we only find a portion of the rectus abdominis, and some digitations of the transversalis muscles.

We have already said that the former was sometimes prolonged very high up in the sternal region; but, as it is this muscle which fixes the chest forwards, it is necessary, whenever we wish to put it in a state of relaxation, to avoid depressing the head upon the thorax in an active manner by the sterno-mastoid muscle, which naturally tends to elevate the thorax. This portion of the rectus muscle is broad and thin; it generally presents the two superior aponeurotic intersections, which unite it firmly to the anterior part of its sheath, whereas it only adheres to the posterior part, which is besides incomplete, by a greater or less abundance of lamellated cellular tissue.

The second, here as well as lower down, seems to be merely a prolongation of the diaphragm, which curves forwards in order to attach itself to the tendinous cord of the median line, through the medium of the aponeurosis in which it terminates. All its fibres are nearly of the same length, that is to say about one or two inches, so that the most superior proceed from the internal face of the cartilaginous border, whence they originate, almost to the linea alba, without furnishing any aponeurosis; the more inferior, on the contrary, terminate at the outer margin of the rectus muscle, where the fibrous sheet of the transversalis already assumes the characters which distinguish it. As to the internal oblique, or ilio abdominalis, it does not exist in the epigastric region.

V. *The Arteries.*

This region is supplied with branches from the internal mammary and intercostal arteries. The former are so disposed, that after having transversed the attachments of the diaphragm, one of the branches passes inwards, between the cartilage of the seventh rib and the xiphoid appendix, in order to anastomose in the form of an arch with a similar branch of the opposite side, upon the fore part of the cartilage, where it is subcutaneous: as this

arch is sometimes of considerable size, it follows that wounds inflicted at this point, although superficial, may be attended with hæmorrhage. The other branch, of considerable volume also, descends perpendicularly between the fleshy fibres, upon the outer side of the rectus muscle, and terminates by ramifying in the subcutaneous tissue. All the intercostal ramifications are similarly distributed; that is to say, being at first situated between the transversalis muscle and the other layers of this region, they afterwards perforate the latter, and inosculate with twigs of the internal mammary. Finally, these arteries are of but small calibre, too small to afford any particular indications in wounds and other diseases of the epigastric region, unless there should be a tumour, or pathological afflection of long standing, in which cases it is possible, in consequence of the long continued active circulation in these vessels, that they may be much enlarged, of which circumstance we should be aware, in order that the necessary precautions may be taken during our operations upon it.

VI. *The Veins.*

There are generally two to each artery: thus the internal mammary, epigastric and intercostal veins are double; they are larger also than the arterial branches; and besides these there are subcutaneous veins. We see then that the venous system predominates over the arterial; nevertheless varices seldom occur here, only occasionally during the latter period of pregnancy, or when the abdomen has been distended for a long time from some other cause, or finally when a large trunk in the abdominal cavity is obliterated; still they are extremely rare; nevertheless we have had an opportunity of observing a disposition of this kind in a man whose case we have published.* In this man, the crural and iliac veins, their principal branches, and the inferior cava itself, were filled with a concrete fibrinous matter of very long standing. The subcutaneous veins of the chest, abdomen, and especially those of the epigastric and sternal regions were as large as a writing quill; they were prominent, tortuous, and here and there sacculated.

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VII. *The Lymphatics.*

All the superficial vessels of this order pass into the axilla, whilst those of the deep strata enter the glands situated in the sub-sternal mediastinal space: therefore it is not uncommon to see swellings of the axillary glands occurring in consequence of acute or chronic inflammations, suppuration, or some other pathological state of the superficial layers of the epigastric region. Blisters, for example, frequently produce this reaction, which then generally turns to the profit of the disease against which we apply them. Intermuscular suppurations, on the contrary, affect the glands within the thorax.

VIII. *The Nerves.*

These are very few in number, appertain to the intercostals, and do not present any special indication in surgery. It is somewhat remarkable, however, that the epigastric region is endowed with such great sensibility, considering the few nerves it contains.

IX. *The Cellular Tissue.*

That which separates the skin from the aponeuroses, having been treated of when speaking of the fascia superficialis, we have nothing more to say respecting it. Between the rectus muscle and the anterior lamina of its sheath, this tissue forms a thin and lamellated expansion; posterior to this muscle it is thicker, especially in the middle, near the xiphoid cartilage, where the aponeurosis scarcely exists. Its lamellæ are extensible and supple: it is this layer which is continuous with the sub-sternal cellular tissue, and as it becomes very compact where it approximates the sub-umbilical line, it follows that fluids which may have penetrated from the thorax or neck to the epigastrium will accumulate here, rather than descend further. We are of opinion then that the accumulation may take place between the peritoneum and the posterior sheet of the aponeurosis, between the latter and the rectus muscle, or indeed before this muscle,

since all these parts communicate with each other. It must be observed, however, that these collections cannot form directly anterior upon the median line, whereas, if the fluid collects in the musculo-peritoneal layer, the tumour will project as much upon the median line, posteriorly, as upon the sides: so that, in order to decide, that an abscess is seated in the subcutaneous layer, it will be sufficient to ascertain whether the fluid is accumulated before the median line.

In the natural state, the epigastric region is convex and prominent whenever the diaphragm is depressed, or the stomach replenished: therefore, during exertion, coughing, yawning, and all deep inspirations, after meals, etc., it projects more or less forwards; during expiration, after digestion, in emaciated persons, and during the efforts of vomiting, it presents, on the contrary, an excavation, which permits us to feel the liver, on the right side, and the pulsations of the cœliac artery and even of the aorta, upon the median line. It is important to bear this in mind, for these pulsations might induce us to believe that an aneurism of the heart, or of the arteries just mentioned, exists, notwithstanding all these organs are in their normal state. The epigastrium is also sometimes the seat of very strong pulsations in certain persons, especially hypochondriacs, nervous and hysterical females, etc. These pulsations, which have engaged the attention especially of Burgraff, Burns and Dr. Albert, of Bremen, are generally nothing more than arterial pulsations; but it also would seem that they sometimes depend upon inexplicable movements of that particular state which we do not comprehend, and which, for this reason, we call nervous.

We will examine the relations of this region with the organs which correspond to it behind, and the dangers consequent upon its wounds when we come to treat of the cavity of the abdomen. In this place we will merely remark that these wounds, even when they involve only the skin and superficial layer, are difficult to unite by the first intention, because, on the one hand, the projection of the ribs interferes with the application of adhesive straps, and, on the other, because the skin is not sufficiently moveable upon the thorax to admit of its being brought from a certain distance, upon the median line, by means of bandages; and, finally, because the solidity of the hypochondria will

not permit this region to be contracted by means of circular pressure, as is the case in the middle portion of the belly.

Sect. 2. Of the Hypochondriac Regions.

These regions are bounded, anteriorly, by the clavi-coxal lines ; posteriorly, by the dorsal region ; superiorly, by the epigastric line, and inferiorly, by the supra-umbilical circle ; or rather, they comprehend that portion of the thorax which corresponds with a portion of the bodies of the five false and the last true ribs ; or, in other words, they are circumscribed, inferiorly, by the curved line which commences at the ensiforme cartilage and is continued along the inferior margin of the chest as far as the eleventh dorsal vertebra, and superiorly, by the line just mentioned ; so that they enter entirely into the dorsal, sternal and especially the costal regions. Consequently, we must defer speaking of the hypochondria until we come to examine the abdominal cavity and its contents.

ART. II. OF THE MESOGASTRIC ZONE.

This is limited by the supra and sub-umbilical lines, and is the most regular of all. It presents us with four regions exactly limited : an anterior, a posterior and two lateral regions.

Sect. 1. The Umbilical or Middle Region of the Abdomen.

This region forms an almost exact square, having the umbilicus nearly in its middle, or rather more approximated to the epigastric than the hypogastric region, and is included between the two clavi-coxal, the supra and sub-umbilical lines.

In infants, and some very thin adults, the umbilicus is prominent, becoming more and more depressed according to the degree of obesity and the advancement of age. It is a species of centre about five inches distant from the anterior iliac spinous processes, six from the apex of the twelfth rib, five and a half from the eleventh, five from the tenth and eighth, and four inches and three quarters from the ninth. The dimensions of this re-

gion are about nine inches inferiorly, and from seven to eight only superiorly.

CONSTITUENT PARTS.

I. *The Skin.*

The integuments of the umbilical region contain numerous but small sebaceous follicles; they adhere very firmly to the navel, and this intimate union of the skin to the umbilical cicatrix, is the cause of the infundibuliforme figure which this point presents in fat people. Upon the median line it is of a more dingy hue, and covered with numerous hairs in the male adult; laterally the skin is not altogether so white, nor its surface so polished, or even regular as in the preceding region; otherwise, it has no other peculiar characters, unless it is that it is more exposed to tractions, so that after the distention of pregnancy and the developement of certain abdominal tumours, it is more frequently covered with wrinkles, when the other tissues have resumed their natural position.

II. *The Subcutaneous Layer.*

This is disposed in the same manner as that of the Epigastrium, excepting that it is of greater thickness and its lamellæ more condensed and compacted, in proportion as they pass upon the umbilicus, with which they are confounded; its adipose cellules, and blood-vessels are also larger and more numerous.

III. *The Aponeurosis.*

It is in the umbilical region that the abdominal aponeurosis presents all those distinguishing characters which were detailed in the general description. Thus, we here distinctly perceive that the sheet anterior to the rectus muscle appertains at the same time to the two obliqui, and that the posterior is derived from the internal oblique and transversalis muscles. In order to comprehend this arrangement and convince ourselves that four laminae here exist, it is sufficient to divide the external oblique

across its fibres and reflect one flap of it towards the linea alba, and afterwards make a similar section of the internal oblique and follow its aponeurosis. We will then perceive that this last fibrous lamina splits at a certain distance from the rectus, and that its sheets immediately separate in order to enclose this muscle, blending itself with the aponeurosis of the external oblique before and with that of the transversalis behind. The linea alba is very strong, and a little narrower above and below than in the middle, where the umbilicus is situated, which, on account of its great surgical importance, deserves particular examination. As the umbilicus transmits the umbilical cord in the fœtus, it forms a communication between the belly and the placenta. At this period it is a complete aperture, which conducts from the cord into the abdomen of the embryo, the two arteries and umbilical vein, the canal of communication between the atlantois and bladder, that of the vesicula umbilicalis and intestines, the omphalo-mesenteric vessels and the digestive canal itself; such, at least, is the disposition which we have discovered in our researches into embryogeny, with which we have been engaged, and which we shall soon lay before the public. The presence of the intestines in the umbilical cord of the embryo, until about two months, explains in a very simple and very natural manner the existence of the congenital exomphalos, and of the umbilical hernia of the fœtus of four, five, six, seven and eight months, which have so much attracted the attention of physiologists; indeed, if the alimentary canal does not completely return into the cavity of the abdomen at the epoch determined by the laws of organization, if the opening at the umbilicus contracts more than is necessary, it is evident that omphalocele will be the consequence. It is true that we have seen in these tumours the liver and some other viscus; but almost always they are formed by the intestines. In 1819 we dissected, under the inspection of M. Mignot, chief surgeon of the general hospital at Tours, an acephalous fœtus, which had at the root of the umbilical cord a tumour as large as the fist, containing almost the whole of the intestinal canal.

At birth also, the umbilical aperture is disposed in such a manner as readily to admit of the escape of the viscera; for which reason we should never apply a ligature around the cord until we

have carefully examined its root, and pushed back into the abdomen the parts which should not be included within it. At this period, the superior semi-circumference of the ring forms a strong fibrous arch, which adheres to the umbilical vein by a pretty supple cellular tissue only: inferiorly, on the contrary, the fibres are less compact and more irregular, but more firmly adherent to the arteries. The peritoneum, which is thick and dense, blocks up the opening behind, and forms but a very slight *cul-de-sac*.

When the infant is separated from its mother, the vessels, urachus and the ring which surrounds them, contract, blend themselves together, and finally form a very strong, very dense, and very unyielding fibrous knot, which is, in short, the most solid point of the abdominal parietes; the wound, or small ulcer, which remains when the cord drops off, unites very intimately with the skin at this point by cicatrization. As fatty vesicles are never developed, nor fluids extravasated in the interval of the fibres which compose the umbilical centre, it follows that its actual thickness can never vary, and whenever it appears prominent it is in consequence of the tenuity of the surrounding parietes; when depressed, it is owing to obesity or general anasarca. But it also happens sometimes that the umbilical ring does not close completely, or with sufficient promptitude, and it not unfrequently enlarges during the first months of existence, so as to admit the introduction of the finger into it through the skin. The cries of the infant, the volume of the viscera, the slight thickness of the parietes, are so many causes which prevent the umbilical aperture from closing, and favour the escape of herniæ: therefore these kinds of displacements are not infrequent during infancy; whilst at a later period, they are, if not impossible, as Scarpa supposes, at least very uncommon: whence it follows, that, in very young children, the exomphalos almost always passes through the umbilical ring itself, whilst in adults, if the hernia is not congenital, the protrusion takes place through a fissure in the aponeurosis. In fact, after puberty, the circumference of the cicatrix presents much less solidity than the cicatrix itself, and the inter-lacing of the aponeurotic fibres leaves several small natural apertures which enlarge by distension, and through which the viscera escape. These natural apertures are

usually filled by adipose lobules, attached to the peritoneum, which sometimes produce *fatty herniæ* here in the same manner as elsewhere; a species of tumour which cannot always be distinguished from true hernia, since they are sometimes attended with all the symptoms of strangulation, and have even deceived the experienced Scarpa himself.

Omphalocele differs from other herniæ with respect to the anatomical arrangement of its coverings: thus, in the fœtus, in infancy, and whenever the hernia is congenital, the displaced organs have made their escape through the umbilical ring, and are enveloped by the peritoneum, by a thin layer of fibrous tissue very adherent to the serous membrane, by the subcutaneous layer, and lastly by the skin; all of which are sometimes so thin and transparent in very young children, that the protruded intestines may be seen through them. In adults, the viscera escape by a point of the circumference of the umbilical knot, which, in these cases, is always thrown to one side of the tumour. The aponeurotic separation sometimes takes place above, at other times below, but more frequently upon the sides; the umbilicus itself is not always upon the median line.

Whenever herniæ protrude through the vascular apertures, they are almost always of a spherical form and of very difficult reduction; they seldom become large, and the strangulation occurs promptly, because these openings are strong, unyielding and very narrow. If the organs escape from the belly through a rent in the linea alba, or general aponeurosis, the hernia may become very large; its figure is then oblong but it rarely becomes strangulated, because in such cases the opening is extensive and the fibres which circumscribe it are of slight density. When it forms suddenly, when the aponeurosis, for example, is torn, in consequence of a violent effort, and along the median line, as the peritoneum adheres very firmly in this situation, it may be ruptured at the same time, and it is in such cases only that umbilical herniæ are destitute of a peritoneal sac. To these, however, we may also add those displacements which occur in consequence of wounds which penetrate the abdomen, and some other cases, in which the peritoneum may give way in consequence of being squeezed for a long time through a vascular aponeurotic aperture: the same thing may occur in fatty herniæ, when followed by

visceral protrusions. But in all cases of congenital hernia, and those which pass through a dilatation of the natural openings in the vicinity of the umbilicus, or through the umbilicus dilated, as it sometimes is in dropsical persons, etc., a peritoneal sac exists, notwithstanding Dionis and J. L. Petit have asserted the contrary.

From what has preceded it follows that, in the operation for strangulated umbilical hernia, three different methods, relatively to the envelopes of the tumour, will present themselves: first, if the hernial sac does not exist, we divide only the skin and fascia superficialis, the last of which is so blended with the cellular layer of the peritoneum as to form but one covering, varying in thickness according to the duration of the disease; next, if the serous membrane has not been lacerated, it would present the same indications as in other herniæ, excepting that it will be thinner and will contain less fluid; which should lead to much greater caution, in order to avoid wounding the displaced viscera; finally, if the affection is congenital, if the organs have actually traversed the ring, equal caution is required in the operation, because the integuments are so much attenuated, the subcutaneous layer and peritoneum so frequently confounded with each other, that it is scarcely possible to distinguish them. In the latter case, and in children, as the natural aperture has not yet lost its tendency to contract, we may hope to effect a radical cure of the hernia previous to its becoming strangulated, and in this respect we cannot but give credence to the numerous cases related in favour of this assertion by the best surgeons, and in our day by Bichat, notwithstanding Lassus has asserted that the compiler of Desault's *Chirurgical Works* was grossly deceived on this subject. As it respects the organs which most usually form omphalocele, we conceive that the small intestines may be found in it; but it is evident that the great omentum, the arch of the colon, and the stomach, are more favourably situated for constituting these tumours.

The circumference of the umbilicus is not the only place at which the aponeurotic fibres may separate and give passage to the viscera. The linea alba, as it ascends towards the epigastrium, or descends towards the hypogastrium, may yield equally. On the external side of the recti muscles the aponeurosis is very

strong and regular in its structure; it is indeed perforated by vascular apertures, but it no longer corresponds to the point at which the principal efforts are concentrated: therefore it is extremely rare that we meet with *ventral herniæ* in this situation.

iv. *The Muscles.*

In the umbilical region we find portions of the recti, internal and external oblique, and transversalis muscles.

(*a*) The *rectus* muscle is here completely enveloped in its fibrous sheath, to which it is connected by three points only of its anterior surface, points which correspond to the tendinous intersections, and which we do not find at the posterior surface. This disposition gives rise to three different observations:—first, abscesses forming between the rectus muscle and the anterior part of its sheath will necessarily be circumscribed by two of these fibrous bands; secondly, these intersections give to the rectus muscle a power quintuple to what it would have if its fibres extended, without interruption, from the pubis to the sternum; thirdly and lastly, they present a perfect model of the cicatrix which unites the two divided extremities of a muscle, and show how slight a foundation there was for the fears of the ancients, relatively to a loss of action in the locomotive organs, if cut transversely to the direction of their fibres.

(*b*) The fibres of the *external oblique* take a more perpendicular direction than in the epigastric region, especially near the spine of the ilium.

(*c*) Those of the *internal oblique* are horizontal inferiorly; the superior, on the contrary, ascend obliquely towards the external margin of the aponeurosis.

(*d*) The *transversalis* approximates the least towards the median line; its fibres are horizontal or incline a little upwards and downwards.

From the manner in which these different muscles are arranged, we may make incisions upon the median line and to the extent of some inches on the external side of the recti muscles, without coming in contact with them: whence are derived a part of the advantages attributed to several of the methods of performing the cæsarean operation. When we are obliged to

cut upon them, the direction of the incision should be from above downwards in the middle of the abdomen, and transversely, at the sides.

v. *The Arteries.*

They are the same with those in the epigastric region, with this difference, that here the mammary and intercostal arteries do not descend to the inferior part of the region; whilst the deep-seated and superficial epigastrics, the circumflex iliac and lumbar arteries are here of considerable magnitude. The epigastrica superficialis ramifies in the fascia superficialis, the deep-seated epigastric and internal mammary in the rectus, principally in its external half, and parrallel to the axis of the body; the others take a transverse direction and are distributed to the lateral muscles: hence an additional reason for following the advice just given, with respect to our incisions, if we wish to avoid hæmorrhage; which accident may be produced, especially, by a wound of the epigastric artery; therefore we always take care to avoid this artery, whenever we perform any operation upon the abdomen. With respect to hysteriotomy, for example, the surgeons who adopted the method of the ancients, that is to say, who incised upon the side, were careful to remove sufficiently from the rectus muscle, in order to avoid the trunk of the epigastric artery or its principal branches. It must be observed, however, that there would be some risk of wounding the lumbar arteries by carrying the incision too far outwards, and if they were cut transversely they might pour out blood in abundance. In paracentesis we plunge the trocar in at the middle of the space which separates the umbilicus from the anterior and superior spinous process of the ilium, both because this is a dependent point as well as to avoid wounding the arteries. We must not believe, however, that this puncture will never be attended with hæmorrhage; for the circumflex iliac and last lumbar arteries send some large branches in this direction, which, if wounded, will pour out a considerable quantity of blood. Neither must we suppose that the operation nearer the median line, will necessarily be attended with hæmorrhage; on the contrary, it will be almost a matter of indifference whether we passed the instru-

ment in at one point or another, if we only had regard to the arteries, because even supposing that its point should fall exactly upon one of these vessels, they are so small and so moveable that they will be liable to roll from under it. But, let this be as it may, if they were wounded, all those of a certain calibre being situated in the deep muscular stratum, and having nothing to fix their position, it would scarcely be possible to apply a ligature around them; in which case the small wax cone, recommended by Bellocq, is the surest means which we can then employ.

If all that we apprehend in the cesarean section is the division of the arteries, of the abdominal parietes, and fleshy fibres, the question as to the most proper point in which to perform it, would be easily decided, and every person would operate upon the linea alba, as advised by Mauriceau, Platner, Varoquier, Solayrès and Baudelocque.

In operating upon the side, we must divide successively, 1st, the skin; 2d, the fascia superficialis, enclosing some branches of the superficial epigastric artery and veins; 3d, the abdominal aponeurosis, or rather a cellular sheet spread over the obliquus externus, and this muscle itself; 4th, the internal oblique, arterial, venous and nervous branches; 5th, the transversalis muscle; 6th, the fascia transversalis, and 7th, the peritoneum. As the incision is carried in the direction of a line dropped from the apex of the last rib upon the middle of the crural arch, the muscles and vessels will be divided perpendicularly to their axis; so that if the latter are of pretty considerable volume, hæmorrhage will ensue, and that if the power of the former is not destroyed, they will constantly tend to draw the lips of the wound asunder.

If we follow the method of Lauerjat,* we will equally have to

* *Lauerjat, Nouvelle Methode de pratiquer l'operation Cæsarienne* 1788, page 140. The abdominal cesarean operation, necessary when the natural passage will not permit the escape of the child, will consist in making a transverse incision five and a half inches in extent through the containing parts of the abdomen, under which will be the womb, between the rectus muscle and spinal column, more or less below the third false rib, according as the womb shall be more or less remote from it. The abdomen being methodically compressed, a bistoury with a convex cutting edge, is made use of for commencing the incision, and a probe-pointed, or concealed straight bistoury for terminating it.

His reason for preferring the transverse incision is that the lips of the wound of

divide the skin, the subcutaneous layer, the thin sheet which covers the external oblique, the fibres of this muscle, those of the internal oblique, the fascia transversalis and peritoneum ; but the incision would be parallel to the transversalis muscle, and the principal arteries, so that muscular retraction and hæmorrhage will be less likely to occur than in the lateral operation ; besides, by flexing the trunk, the lips of the wound, the external angle of which will form the most dependent point, may be readily approximated and their reunion more speedily accomplished.

In this region we find numerous inosculations between the branches of the subclavian artery and those of the external iliac ; between those of the thoracic and abdominal aorta, and of all promiscuously together ; inosculations by means of which the circulation may be supported in case the external, internal or common iliac arteries and even the abdominal aorta are obliterated.

VI. *The Veins.*

The superficial veins ramify in the fascia superficialis, and are sometimes of very considerable volume ; they accompany the subcutaneous arteries, and enter the hypogastric region ; the deep-seated likewise follow the arteries and have the like arrangement. The anastomoses, relative to the vena cava, are similar to those of the arteries, as mentioned above.

VII. *The Lymphatics.*

There are no lymphatic glands in this region, but the vessels are pretty numerous : they are arranged in two sets ; those situated above the umbilicus pass to the axilla or cavity of the thorax ; the sub-umbilical lymphatics, on the contrary, descend to the groin or pelvis. It is of some consequence to recollect this arrangement in relation to the application of frictions for the venereal and other diseases, and in order that we may account for the metastases, or sympathetic affections, which sometimes man-

the womb always approximate, whereas when the womb is incised longitudinally, they will separate.—*Transl.*

ifest themselves in consequence of diseases of the umbilical region.

VIII. *The Nerves.*

In this region, there are only a few filaments from the last two intercostal branches, from the first lumbar and *ilio-scrotal* nerves. They are of no surgical importance.

IX. *The Cellular Tissue.*

We have already noticed that this tissue was blended with the fibrous texture at the umbilicus. In the subcutaneous layer, it includes adipose cells larger and more numerous than at the epigastrium, and forms a thicker fascia. In the sheath of the rectus muscle, it forms a thin layer anteriorly, where it is interrupted by the intersections; posteriorly it is thin also, but continuous and only slightly adherent, which permits fluids, extravasated within it, to gravitate readily from above downwards. Between the aponeuroses and the peritoneum, the cellular tissue is dense, compact, more adherent upon the median line than laterally and inferiorly, where the fascia transversalis becomes more distinct. Between the two oblique muscles and the transverse, its lamellæ are very delicate, and seldom enclose adipose vesicles. The peritoneal layer, in this region, as well as in the others, gives attachment to a certain number of fatty processes, the volume and quantity of which increase with age and *embonpoint*; and it also sends off sheaths to the vessels. From the foregoing it follows, that abscesses situated in the sheath of the rectus, cannot extend upon the lateral parts, but must project forwards, inwards, upwards or downwards; whilst those which are situated between the muscular strata, may easily make their way into the lateral regions, iliac fossæ, etc.

Sect. 2. Region of the Flanks, or of the sides of the Abdomen.

This region is much less extensive than the preceding, and is bounded superiorly by the margin of the thorax or supra-umbilical line; inferiorly by the crista of the ilium; anteriorly by the

clavi-coxal line, or the umbilical region; and posteriorly, by the sacro-spinal muscular mass, or the scapulo-coxal line. Upon its surface we observe, in fat persons, women especially, a kind of bulging inferiorly, which is sometimes very large; otherwise it is more or less excavated, prolonging the lateral depressions of the abdomen, and producing a hollow which interferes with the exact application of bandages, when it becomes necessary to give them a certain breadth.

COMPONENT PARTS.

I. *The Skin.*

The integuments are generally of greater thickness in this region than anteriorly, and their characters are very nearly allied to those of the dorsal region. The skin of the flanks is never covered with hair, but it encloses sebaceous follicles, deeply imbedded in the dermis. Notwithstanding its strength and density it is extensible, and yields considerably to the enlargement of tumours developed beneath it; on this account also, its solutions of continuity are easily united by the first intention, and indicate the employment of adhesive straps or sutures, whenever the uniting bandage is not indispensable, because the latter interferes with the action of the viscera, by the compression it necessarily produces.

II. *The Subcutaneous Layer.*

Superiorly, inferiorly and anteriorly, it is continuous with the general fascia superficialis, and only presents some varieties in thickness; but posteriorly, this tissue forms a considerable mass, which fills the pretty deep depression existing between the last rib and the spine of the ilium, the posterior margin of the obliquus externus and the muscular mass common to the longissimus dorsi and sacro-lumbalis. This layer is composed of adipose cells, of very small vascular and nervous twigs, and especially of a fibro-cellular tissue, the filaments of which intersect each other a great number of times, forming in this mass a multitude of locules, and are intimately connected to the integuments, on the

one hand and the aponeurosis on the other; so that in fat, or dropsical subjects, we almost always observe a greater or less hollow in the region of the flanks. Posteriorly, under the twelfth rib, this layer is continuous with the cellular tissue of the interior of the thorax; from which circumstance, the layer when vertebral caries exists, or matter forms around the dorsal column, the pus may descend under the skin of the flank and give rise to those sympathetic depositions, unfortunately too common, generally known by the name of *abcès par congestion*.^{*} These abscesses require, in this situation, the greatest attention, because the abundance of cellular tissue here also renders idiopathic abscesses very frequent; and if the latter are developed very slowly, if they constitute what we call chronic abscesses, it will not always be easy to distinguish them. Then, if these abscesses are left to take their own course, the resistance of the skin prevents the collection from escaping externally, and a considerable burrowing takes place; or the aponeurosis yields, is destroyed along the external margin of the muscular mass of the loins, sometimes near the rib, or nearer the iliac crest, in which case the pus makes its way behind the peritoneum, and may descend even to the groin; so that in this way *dépôts by congestion* are formed in an order inverse to their ordinary mechanism. The following fact comes in support of this assertion.

On the 24th Feb. 1825, a man named Adet, ætat. an 28, died at the Hospital of *la Faculte*. Three years previous to this, being of a strong constitution and habitually enjoying good health, he was attacked with pain in the loins, which was followed, in about four or five months, by a tumour on the left side, about the size of a child's head; at the expiration of three months more the tumour was opened, and its contents, which were pus, discharged. The suppuration was at first copious, but afterwards gradually diminished, and at the end of sixty days the orifice was cicatrized. In 1824 the pain in the loins returned, and a tumour appeared in the right side, which increased rapidly. In the month of December, it occupied the whole of the flank and lumbar region of this side. Two moxas were applied, and, by

^{*} The term *Abcès par congestion*, is applied to those abscesses which derive their origin from a remote source.—*Transl.*

suppuration of one of them, the cavity was opened in the beginning of January 1825. In the evening, febrile reaction took place, pains were felt in the pelvis and this man died in an adynamic state, without being much emaciated. The skin was detached throughout the whole extent which the tumour had occupied; the cellular layer was destroyed; the aponeurosis upon the muscles of the loins was but slightly thickened; in the excavation of the flank this sheet was rarefied, transformed, as it were, into cellular fungi: the cavity extended as far as the anterior part of the last rib, but did not penetrate the abdomen at this point; it descended between the ilio-lumbar ligament and the spine of the ilium, becoming continuous with the iliac fossa, which was filled with pus; but in no part was caecæ observed. Now it seems evident to us, that the seat of this disease was primitively in the subcutaneous layer, and that the pus had penetrated into the pelvis only on account of the anatomical disposition of the parts.

In consequence of this disposition, therefore, we think that, in order to avoid like dangers, it is necessary to open early and extensively, chronic abscesses developed in the loins. The following case illustrates this opinion.

Bourgeois, a waiter, 28 years of age, was received into the Hospital of *la Faculté*, on the 28th July 1825, in consequence of a tumour which had existed in the right flank for two months, and had made its appearance without any known cause. Prof. Bougon punctured it, and let out eight ounces of clear and flocculent pus. At each subsequent dressing a great quantity of similar matter flowed out; six days afterwards, fever from re-absorption manifested itself, and was soon followed by diarrhœa. The countenance sunk rapidly, and a fatal termination was apprehended, when it was decided to lay bare the bottom of the abscess. A crucial incision was made; three days after the purging had ceased; the suppuration gradually diminished; the fever promptly disappeared, and this abscess soon presented only the phenomena of an ordinary wound, which was completely cicatrized on the 10th of October. It is natural to suppose that, if this disease had been abandoned to the resources of nature, it would have terminated as in the preceding case, and that if the

first opening had not been enlarged, it would equally have led to death.

III. *The Aponeurosis.*

It results from the union of three laminæ, one of which is continuous with the posterior aponeurosis of the sacro-spinalis muscle ; a second, which originates from the extremity of the transverse processes of the lumbar vertebræ, and the third is the sheet which passes before the quadratus lumborum muscle ; all of which unite in the hollow of the flank, and form but one sheet, which is properly speaking, the aponeurosis of the region. This aponeurosis soon gives origin to the transversalis muscle by its anterior margin, and cellular laminæ are detached from its external surface, which are expanded upon the oblique muscles ; it is dense, compact, and very thick in the centre ; becoming thinner as it approaches the border of the floating rib, and almost cellular at the posterior part of this border ; therefore, it is at this point that suppurations of the liver, on the right ; of the spleen, on the left ; of the kidneys and thoracic cellular tissue, on both sides, pass from the pectoral and abdominal cavities into the lumbar region. It is also pretty strong inferiorly, where it is connected with the ilio-lumbar ligament ; so that, in relation to purulent sinuses they are most likely to form superiorly, inferiorly and posteriorly. As it regards the formation of herniæ, on the contrary, they occur at the point where its fibres become transformed into muscular tissue.

IV. *The Muscles.*

(a) A small portion of the *latissimus dorsi*, or of its aponeurosis, in ascending behind the thorax, crosses the superior and posterior angle of this region, so that it is between the anterior surface of this fleshy portion and the fascia just examined, that the principal cellular mass is situated, and that fistulous ulcers, consequent upon abscesses of the loins, almost always extend upwards, inwards, and backwards. It is for this reason that, if we wished to expose the whole extent of the bottom of these cavities, we must incise the border of the *latissimus dorsi* muscle.

which should also be noticed in these diseases, in order that we may not decide that the aponeuroses are destroyed, and that the pus comes from the deep-seated parts, whilst the disease is confined entirely to the *fonte* of the cellular layer.

(*b*) The *obliquus externus* has no aponeurosis in this region : but its posterior margin is enveloped by some lamellæ of that of the transverse. As this muscle descends from the last ribs upon the crest of the ilium, it crosses the internal oblique almost at right angles, so that it leaves the latter uncovered inferiorly and posteriorly.

(*c*) The *internal oblique* ascends almost perpendicularly, in order to attach itself to the inferior margin of the twelfth rib. It is covered, anteriorly, by the external oblique ; posteriorly and superiorly, by the latissimus dorsi ; and throughout the rest of its extent, by the cellular layer and skin. It is only separated from the transversalis by a thin sheet of lamellated tissue.

(*d*) The *Transversalis* is prolonged a little further backwards than the other muscles, by means of its fascia ; otherwise, it is covered by them, and is even blended with their posterior margin. It is separated from the peritoneum by the fascia transversalis only.

From this muscular arrangement, it follows, that the form of the excavation of the flank is triangular, that it is circumscribed by the sacro-spinalis and latissimus dorsi, posteriorly ; by the posterior margin of the obliquus externus, anteriorly ; inferiorly, where it is broadest, by the spine of the ilium ; internally and posteriorly, by the aponeurosis ; and internally and anteriorly, by the obliquus internus and transversalis muscles. As these last two boundaries are of but slight thickness, as the transversalis exists alone in one point of a certain extent, it follows that the parietes of the belly are here very thin, and that the viscera, in consequence of a violent effort, may lacerate them, and form a hernia in the region of the flanks, as was observed by J. L. Petit. It is also for this reason that some surgeons have advised cutting down to the aorta in this situation, without wounding the peritoneum, as has been done in quadrupeds—dogs, for example. Callisen also recommended establishing an artificial anus here, in children born with the rectum imperforate ; others have proposed selecting this part for the removal of foreign bodies

from the colon, and even for extracting renal calculi. It would seem, if we can give credit to the case of consul Hobson, or depend upon that of Frank Archer of Meudon, that the latter operation has been attempted upon the living subject. Be this as it may, we have reason to be astonished that Douglass, of Edinburgh, was not able to expose the kidney even upon the dead body, in attempting to perform nephrotomy: in fact, without stopping to inquire whether the indications are ever so positive as to demand the extraction of renal calculi, we do not think, at least from the anatomical relations of the parts, that it would be a difficult matter to reach this secretory organ. In order to expose it in the most suitable point, a vertical incision should be made between the scapulo-coxal line and the lateral prominence of the loins, from the posterior surface of the second inferior rib nearly to the spine of the ilium; we would then have to divide, 1st. the very thick skin; 2d. the adipo-cellular tissue, which will be more or less abundant, according to the embonpoint of the subject; 3d. the origin of the transversalis muscle or its aponeurosis; 4th. a second layer of adipo-cellular tissue, and then the kidney will be found lying upon the anterior surface of the quadratus lumborum muscle, passing a little beyond it, and extending two or three inches lower than the last rib.

v. *The Arteries.*

These are derived from the lumbales, ilio-lumbalis, reflexa ilii, some branches from the diaphragmatica, mammaria interna, and intercostales inferiores. The former are at first situated between the peritoneum and the aponeurosis, between the peritoneum and the transversalis muscle; then they perforate the latter, run between it and the obliquus internus, and finally ramify in the latissimus dorsi and obliquus externus.

All the others are dispersed among the muscular fibres, and form a net-work similar to that in the umbilical region; but it is sufficient to remark, that the principal branches are placed transversely, and that, in the point where the incision should be made, in order to penetrate to the kidney, these vessels are still under the peritoneum, so that they may be easily avoided.

VI. *The Veins.*

The veins of the sides of the belly empty into the epigastrics, anteriorly; into the internal mammary and intercostals, superiorly; into the circumflex iliac, inferiorly; and into the lumbar veins, posteriorly. They accompany the arteries, have many twigs in the subcutaneous layer, but are not so large as to require much surgical attention.

VII. *The Lymphatics.*

These are few in number, and run in two different directions; the superior vessels ascending to the axilla and cavity of the chest; the inferior descending to the groin and interior of the pelvis.

VIII. *The Nerves.*

The branches which are distributed to the umbilical region pass through the flank, as well as the last intercostals and the first twigs of the lumbar plexus, which send off filaments to this region. They ramify among the muscles, and present nothing very remarkable.

IX. *The Cellular Tissue.*

Between the peritoneum and transversalis muscle, this element forms a thin, dense and compact layer, which is continuous with the fascia transversalis, and which becomes thicker, more supple, and sometimes filled with adipose vesicles, as it approximates the quadratus lumborum muscle; it insinuates itself into several small apertures of the aponeurosis and thus communicates with the lamellæ which we find between the three muscular layers, on the one hand; and, on the other, with the fibro-cellular tissue of the excavation of the flank; these means of communication are more numerous superiorly; and, as the cellular tissue of the inferior surface of the diaphragm, that interposed between the pleura and posterior gutters of the thorax

and passing through the crura of the diaphragm and fibres of the transversalis muscle, equally communicate with it, we may consider the cellular mass of the flank as a central point, a species of common *rendezvous* for almost all the cellular laminæ of the posterior part of the trunk.

In penetrating from the surface towards the cavity of the abdomen, we find the following order of superposition: 1st, the skin, which is thicker posteriorly than anteriorly; 2d, a thin lamellated and filamentous cellular tissue between the latissimus dorsi and skin; 3d, the said muscle, but at the superior and posterior part only; 4th, the cellular layer again, very thick internally, becoming more and more attenuated externally; 5th, the aponeurosis of the transversalis posteriorly; a little more anteriorly the transversalis muscle, the internal oblique, then the descending oblique which is altogether external, where these three muscles are superposed; so that, in order to traverse them at this point, we must pass through, first, a delicate cellular layer upon the first muscular plane; next the fibres of the external oblique, which run downwards and forwards; thirdly, a still more delicate and especially less compact cellular layer than the first; then the internal oblique, with its fibres running in an inverse direction to the preceding; a third cellular stratum, and lastly the fibres of the transversalis muscle directed transversely; 6th, the sub-peritoneal cellular lamellæ more loose and abundant posteriorly, thinner and much less extensible anteriorly; 7th, the peritoneum. Ventral herniæ, protruding between the margins of the obliquus externus and latissimus dorsi, will be enveloped by the skin, the subcutaneous stratum, the thin fibro-cellular expansion which covers the external surface of the muscles, the cellular layer of the peritoneum and by the peritoneum itself. The muscular fibres will be separated, or the aponeurosis perforated.

Sect. 3. The Lumbar Region.

This region is bounded, superiorly, by the dorsal portion of the thorax; inferiorly, by the posterior part of the hypogastric circle, and laterally by the scapulo-coxal lines. It is longer in its middle than lateral portions, on account of the approximation of

the crest of the ilium to the last ribs. In the vertical position, it presents a concavity which is scarcely evident in children, but very distinct in females, especially in those who have contracted the habit of forcibly drawing the pelvis backwards in order to render the chest more prominent: it is also considerably increased in women who approximate the termination of pregnancy, and at all times that we carry the axis of the body backwards, for the purpose of sustaining a heavy burden. When we lie on the back, or bend the body forwards, this concavity disappears. As these variations in the curvature of the lumbar region alter the relative directions of the axis of the trunk and pelvis, they consequently have a great influence over the process of labour and the formation of herniæ.

Upon the median line we observe a longitudinal groove, which increases in depth in proportion as it approximates the sacrum, in the middle of which we may readily feel the ridge formed by the spines of the vertebræ. This groove, which is the continuation of that of the back, is more evident in the erect posture, and in fat or muscular subjects; then the ridge appears much deeper. In childhood, old age, emaciated persons, and when the body is inclined forwards, the groove, scarcely exists, and the vertebral processes are quite prominent.

On each side of this gutter we observe an eminence which is also proportionate to the embonpoint of the subject and the volume of the sacro-spinal muscle, and susceptible of the same variations as the median groove in the different attitudes, etc.

Superiorly and externally, near the flank, we distinctly feel the twelfth rib, and, inferiorly, the posterior prominence of the iliac crest.

CONSTITUENT PARTS.

I. *The Skin.*

It is in this region that the skin is the thickest, and differs from that of the back only in possessing transverse wrinkles, which are occasioned by the flexion and extension of the trunk.

II. *The Subcutaneous Layer.*

Upon the sides, this layer is composed of lamellæ, filaments, adipose cells, arterial and venous twigs; upon the median line, where it unites the skin intimately to the supra-spinal ligament, it is compact and of a fibrous nature, whilst externally, the integuments and aponeurosis have only very slender adhesions. In consequence of this arrangement, pus and other fluids never collect in the median groove of this region, and whenever abscesses exist on each side of the spine, at the same time, they never communicate with each other, but, on account of the resistance of the skin, and the very strong fibrous sheet which covers the muscles, the matter makes its way towards the region of the flanks.

III. *The Aponeurosis.*

The first, and principal lamina, is attached to the posterior fourth part of the spine of the ilium, to the sacrum and spinous processes of the lumbar vertebræ, and gives off from its external surface the aponeurosis of the latissimus dorsi, and likewise that of the serratus posticus inferior. More externally, it dips down into the excavation of the flank, and concurs in forming the fascia of the transversalis muscle. It is of considerable thickness, and its fibres intersect each other in every possible direction; its extensibility is very limited and it is very seldom torn during violent efforts of the muscles; it converts into a canal the vertebral grooves and gives a solid support to the longissimus dorsi and sacro-lumbalis, strongly compressing them during their contractions and thereby increasing the power of their action.

The second aponeurotic lamina originates from the apex of the transverse processes of each lumbar vertebra by as many distinct slips, which grow wider and blend themselves together previous to issuing from between the sacro-spinalis and quadratus lumborum muscles. These fibrous slips form a certain number of arches, under which morbid fluids, generated within the abdomen, may readily penetrate into the sheath of the muscular mass lodged in the vertebral gutters. As this aponeurosis enters the lateral region it

becomes confounded with the preceding ; superiorly it is attached to the last rib and lies upon the third layer. The latter, which is much thinner than the two former, is continuous superiorly with the ligamentum arcuatum, and inferiorly, with the ilio-lumbar ligament. Between the psoas muscle and the base of the transverse processes it is cellular in its structure, and only becomes distinctly fibrous at the anterior part of the quadratus lumborum, on the outer part of which this layer is blended with the middle lamina.

IV. *The Muscles.*

(a) The *Sacro-spinalis* is the common mass which comprises the sacro-lumbalis, longissimus dorsi, and multifidus spinæ muscles, and is included within a complete sheath, formed, posteriorly, by the posterior sheet of the aponeurosis ; anteriorly, by the middle sheet and the posterior surface of the transverse processes, and internally, by the spinous processes. This mass may be considered as a long and strong power which acts upon the vertebral column in general, as upon a lever of the third order, and upon each vertebra in particular, as on a lever of the first order. In the erect posture, walking, running, dancing, and the act of carrying burdens, this muscle alone almost entirely supports the equilibrium of the trunk ; therefore when fatigued, under such circumstances, we feel a kind of dull heavy pain in the loins ; and it would seem that the sufferings which are sometimes experienced in this region, after exertion, etc., are owing solely to irritation or rupture of the fleshy fibres. The rheumatic affection, called *lumbago*, also appears to have its seat here ; so that, in this disease, the slightest movements of the trunk, and those which respiration require, are very painful.

(b) The *quadratus lumborum*, or *ilio-costal*, appertains entirely to this region, and is situated between the last rib, the spine of the ilium and the ilio-lumbar ligament, on the one hand ; and, on the other, between the aponeurosis of the origin of the transversalis abdominis and the transverse processes, upon the fore part of which it is applied. It is covered by a thin fibrous sheet, and is separated from the kidney and colon by an adipo-cellular cushion of greater or less thickness. The quadratus lumborum, therefore,

is ensheathed before, in the same maner as the sacro-spinal is behind, and its arrangement is such that it acts principally in fixing the chest, in order to maintain the equilibrium in standing, or counter-balance the action of the scaleni muscles, during inspiration.

(c) The *intertransversales lumborum* are stronger than those of the cervical region and are situated between the two preceding masses. They are traversed by the posterior branches of the lumbar nerves and arteries.

(d) The *interspinales* are almost blended with the sacro-spinalis, and the *psoæ* muscles appertain to the cavity of the belly.

v. *The Arteries.*

In this region we find the inferior intercostal, the four or five lumbar arteries, the ascending branch of the ilio-lumbalis, as well as some twigs from the circumflex iliac and epigastric arteries.

The first soon abandons the twelfth rib, and passes in an oblique direction over the anterior surface of the quadratus lumborum to the transversalis muscle; the second come out from beneath the psoas and take a transverse course towards the same parts, and the third, which originates from one of the iliacs, ascends and is principally lost in the cellular tissue. Each of the lumbar arteries gives off three principal branches, opposite to the space which separates the transverse processes; one which enters the spinal canal, through the intervertebral foramen, and ramifies in the membranes and medulla; the second passes backwards, divides and subdivides among the muscular fibres, and terminates in the subcutaneous layer; the third, which is the trunk itself, continues the direction primitively indicated; it is situated behind the great sympathetic and spinal nerves, distributes twigs to the fat and cellular tissue enveloping the kidney, but not to the substance of this organ; it also sends some ramuscles to the quadratus lumborum and finally terminates, in the region of the flank, between the broad muscles of the abdomen

In consequence of the foregoing arrangement, we may readily perceive that there is not much danger of hæmorrhage from operations performed upon the lumbar region, until the instru-

ment has penetrated beyond the quadratus lumborum muscle, and that this accident will more frequently succeed perpendicular than transverse divisions.

VI. *The Veins.*

They are larger than the arteries, pass to the vena cava, and communicate freely with the plexus which extends along the anterior wall of the vertebral canal: whence it follows that by throwing injections into the primitive iliac veins, or the vena cava, just above its bifurcation, they will return immediately by the superior veins; and it is possible, in this way, to inject the whole of the splanchnic venous system. The ramifications of the lumbar and ilio-lumbar veins, in the sub-peritoneal adipose tissue beneath the kidneys, form what we call the *pampiniforme* plexus.

VII. *The Lymphatics.*

This system is not very abundant; the superficial vessels are continuous with those of all the surrounding regions. The deep seated set, on the contrary, take their course principally to the glands which are situated upon the sides of the vertebræ and behind the mesentery; so that a blister, a moxa, or any species of inflammation, in the lumbar region, may be attended with tumefaction of the glands of the groin, neck or axilla; whereas a deep-seated abscess, a disorganization of the muscles or of the intermuscular cellular tissue, might produce an engorgement of the glands of the mesentery.

VIII. *The Nerves.*

In this region we find the whole of the lumbar plexus; but as it is enveloped by the psoas muscle, we will defer its examination until we come to treat of the cavity of the abdomen. In this place, we will merely observe that the last intercostal nerve and the first two muscular branches of the plexus, glide over the anterior face of the quadratus lumborum, in their course to the sides of the abdomen: consequently the posterior branches of

the spinal nerves are the only ones which ramify in the muscles of this region, where their distribution is exactly similar to that of the corresponding costal branches; with this difference, however, that several of the nervous filaments which creep for a considerable time in the subcutaneous layer, preserve a certain volume until they terminate in the skin.

IX. *The Cellular Tissue.*

The musculo-peritoneal cellular tissue is lamellated, supple, and sometimes contains very large adipose vesicles; it forms a cushion of greater or less thickness, according to the condition of the subject, which occasionally becomes the seat of inflammation. Superiorly and internally it is continuous, on the one hand, with the long cellular train which exists on the fore part of the spine, and the sub-serous tissue of the diaphragm or chest; on the other, with that of the fossa iliaca below, and the sub-peritoneal of the flank. As its lamellæ are very compact in the latter direction, whilst in all the others they are lax and very extensible, it follows that, in suppurations occurring in this layer, the morbid fluids are, as it were, confined upon the sides by the adhesion of the peritoneum to the transversalis muscle or its aponeurosis, but that they may infiltrate with the greatest facility towards the pelvis or thorax. That portion of the cellular tissue which is included in the sheath of the quadratus lumborum scarcely ever contains fat; it is very delicate, and communicates anteriorly, between the muscular attachments, and especially near the last rib, with the preceding layer; so that pus, etc. secreted in one of these points, may pass very readily to the other. That which is situated in the sacro-spinal canal sometimes contains adipose cells and is connected by several filaments, which traverse the posterior sheet of the aponeurosis, with the subcutaneous layer. Between the muscular fibres, it is thin and delicate, and forms near the rib, a bond of union with all the layers and with the cellular mass of the excavation of the flank.

x. *The Skeleton.*

It comprehends the five inferior vertebræ and their ligaments, and is remarkable in many respects.

(*a*) The bodies of the bones gradually become thicker in proportion as they descend, especially their anterior portion, causing a very considerable convexity in this direction.

(*b*) The cartilages are similarly disposed and of considerable strength; they adhere so firmly to the bodies of the vertebræ that it is more easy to break the bones than to detach the cartilages from them.

(*c*) The spinous processes are short, but broad and horizontal; which permits very considerable flexion backwards. The ligamentum inter-spinale which unites them, in filling up their interval, is quadrilateral, of a yellow colour and very strong; the supra-spinal ligament is also thicker in this than in any other point of the vertebral column, which circumstances explain the tendency of the trunk to straighten itself after having been flexed very much forwards.

(*d*) The transverse processes are thin, horizontal, and very remote from each other, thereby admitting of extensive lateral motion. In short, these different characters are all favourable to mobility, which is, in fact, much greater in the lumbar region than in the other portions of the spine.

(*e*) The articular processes are placed perpendicularly; the inferior look outwards and are approximated to each other; the superior are more remote, and look inwards and backwards. From this disposition, it follows that these facets are wedged into one another in such a manner that they cannot slide in any direction; so that, notwithstanding the extensive motions of the vertebral column, their luxations are impossible, unless accompanied with fracture. Behind the superior, there is a small tubercle, pointed out by Albinus, and since by Béclard, into which the tendons of the intertransversales lumborum are inserted.

(*f*) The plates (*laminæ*) are short, thick, and pretty broad; but those of one vertebra do not over-lap those of the vertebra below it. Their horizontal position gives to the ligamentum flavum a square form, and renders a certain extent of it visible from

the exterior; so that a pointed instrument might be passed transversely to the axis of the body into the spinal canal, without touching the bones.

(*g*) The spinal canal is rather triangular than circular; between the dura mater and vertebræ, there is an abundance of adipo-cellular tissue. The spinal veins are of considerable size, which gradually increases as they descend, on account of the numerous branches which they receive from the spongy tissue of the bones: these veins, with which we are better acquainted, since the investigations of M. Breschet, form a very complicated plexus, and empty their blood into the lumbar veins. The spinal marrow terminates on a level with the second lumbar vertebra in those nervous cords, enveloped by their neurilemma, called *cauda-equina*. These nerves are the only ones which are distributed to the inferior extremities, and as the roots of several of them originate as high up as the ninth vertebra, an injury of the spinal marrow at the superior part of the lumbar region, may not be followed by paraplegia: from this circumstance, we may explain, to a certain extent, the cases detailed by Ferrein, in the *Mémoires de l'Académie des Sciences*, and by Desault, in his *Journal*; cases in which we see that a very severe wound of the medulla spinalis, at the inferior part of the dorsal region, is not always attended with paralysis of the lower extremities. But in relating these facts in the *Archives générales de Médecine*,* we have noticed others which will not accord with a similar explanation.

It appears, then, from what has preceded, that although this portion of the spine, destined to protect the nervous system, is no longer sheltered by the ribs, it is still, in a measure, secured against external violence by its curvature, which renders it deeper seated, and by the thick muscular mass which surrounds it; that, moreover, the spinal cords contained within it, being of less vital importance than in the superior regions, nature stands less in need of protection, whilst that portion of the vertebral column which concerns locomotion required a particular arrangement, in order that it might admit of extensive mobility, without subtracting from its solidity: thus, we have seen that the spinous

* Février, 1825.

and transverse processes are horizontal, and that the intervertebral substance, which merits further notice, is of considerable thickness. The soft and almost incompressible texture, in fact, which is situated in the centre of each of these substances, throws nearly the whole pressure of the body, during its diverse inclinations, upon one of the points of its circumference, so that the fibro-cartilage, being very elastic, but much more compressible at its periphery, yields and becomes attenuated where it is most firmly compressed, and repels towards the opposite direction, which is then thickest, the central semi-fluid, which thus forms a sort of moveable pivot, around which all the movements are executed. When the lumbar curvature is very great, these intervertebral fibro-cartilages must necessarily be distended, and put the ligaments which surround them more or less upon the stretch.

Before we quit this point, we may further remark, that in no part does the body of the vertebræ contain so many arterial and venous vessels, or such large areolæ, a tissue so spongy, or is surrounded with so much cellular texture and such broad ligaments; in short, which presents so great a degree of vitality: if we add to these the continual efforts which are concentrated upon this portion of the vertebral column, we may naturally account for the frequency of its caries, inflammations, and other morbid alterations.

We will now examine the order of superposition of the parts contained in the lumbar region.

Upon the median line we find, 1st. the skin, which is very dense and compact; 2d. the subcutaneous layer, which is rather fibrous than cellular, never containing adipose vesicles, uniting the integuments very intimately to the supra-spinal ligament, and preventing infiltrations from passing from one side of the median line to the other; 3d. the supra-spinal ligament, distinguished from the aponeurosis by the longitudinal direction of its fibres; 4th. the spinous processes, interspinal ligaments, and muscles; 5th. the plates (*laminæ*) of the vertebræ and the *ligamenta flava*; 6th. the articular processes directed backwards, and nearly approximated to the base of the spinous processes; 7th. the vertebral canal, in which we see some cellular tissue and almost fluid fat, the *dura mater*, *arachnoid*, *medulla*, and nerves; then again

the arachnoid, dura mater, a delicate supple adipo-cellular tissue, some arterial branches applied upon the bodies of the vertebræ, the veins of the spine, covered from space to space by the posterior vertebral ligament ; 8th. the bodies of the vertebræ and the fibro-cartilages, covered by the anterior vertebral ligament* and some cellular tissue, then by the crura of the diaphragm, the lumbar arteries and veins, the great sympathetic, some lymphatic glands, the origin of the thoracic duct, the aorta, vena cava, etc.

Upon the sides, we meet with, 1st. the skin, thicker but less dense than upon the median line ; 2d. the cellular layer, enclosing very distinct nervous filaments, vascular twigs, and numerous adipose cells ; 3d. a thick aponeurosis, with interlacing fibres, presenting a small number of vascular apertures ; 4th. a thin reticulated tissue, sometimes containing a soft adeps ; 5th. the common fascis of the sacro-lumbalis, longissimus dorsi and interspinales muscles, in which we see the principal divisions of the arteries, veins and nerves ; 6th. internally the transverse processes, the inter-transversales muscles ; externally, another cellular layer and the middle sheet of the aponeurosis ; 7th. the quadratus lumborum muscle and some vessels ; 8th. the anterior aponeurosis ; 9th. and lastly, the sub-peritoneal and lamellated tissue, enclosing adipose cells, the lumbar arteries, veins and nerves.

If we recollect what was said when considering the posterior regions of the chest and neck, we will see that the bodies of the vertebræ are more removed from their processes in proportion as they approximate the sacrum ; whence it follows, that the vertebral canal, being thereby inclined more forwards, is more difficult of access the lower we attempt to discover it ; and even in the dorsal region, where the transverse processes are very long and much inclined backwards, the vertebral gutters appear deep and broad, so that the plates, which form the arch of the canal, are less apparent and almost without the reach of the knife : nevertheless, about two years since, the attempt was made in London to apply the trephine upon them, for the purpose of raising portions of bone depressed upon the medulla spinalis ; it is needless to say that the young man died after the operation.— Nothing could justify similar attempts in the lumbar region.

* Ligamentum commune anterius.

ART. III. HYPOGASTRIC OR INFERIOR ZONE OF THE ABDOMEN.

This zone does not admit of the same division as the preceding; its posterior half will be subdivided into the region of the haunches, or glutæal, and into the sacral region. We will examine, at present, its anterior half only, which is bounded inferiorly by a semi-circular line commencing at the anterior superior spinous process of the ilium, following the course of Poupart's ligament, passing upon the symphysis pubis, and terminating at the same point on the opposite side. The middle part of this portion will retain the name of hypogastric region; and the sides will be called iliac regions.

Sect. 1. Of the Hypogastric Region, or Hypogastrium, properly so called.

This region is bounded laterally by two lines, drawn slightly oblique from the hypogastric circle, along the external margin of the rectus muscle upon the body of the pubis immediately on the outer side of its spine; superiorly by the umbilical region, and inferiorly by the symphysis and body of the pubis.

Upon its surface, and in fat persons, we observe a transverse furrow, above the mons Veneris, or pecten (*pénil*), with which it is continuous inferiorly. Upon the median line the gutter, indicated in the superior regions of the abdomen, no longer exists. In pregnant women the hypogastrium is at first the only point of the belly which distends, rises and is thrown forwards; and we frequently observe in those who have had several children, a fold, of greater or less thickness, which inclines upon the fore part of the mons Veneris.

CONSTITUENT PARTS.

1. *The Skin.*

This membrane is generally thin, supple, and very extensible; smooth, white and delicate in young girls, becoming brown and rugous with age; wrinkled and folded in women who have had a

numerous offspring, as well as in those whose abdomen has been previously over-distended by ascites, or polysarcia. In its middle and inferior portion, in the adult, it is covered with hairs, and wherever these hairs are situated numerous sebaceous follicles exist, which pour out an abundant secretion. During pregnancy a brownish streak is frequently observed extending in the direction of the median line towards the xiphoid cartilage, which is owing to an increased secretion of the colouring matter. The skin of this region is also very frequently the seat of those *vergetures*, [*vitiligo hydropicarum gravidarum*, J Frank.] produced by the subcutaneous veins, which we will find more abundant in the extremities.

II. *The Subcutaneous Layer.*

This tissue is very thick and consists upon the median line and, in its inferior fourth portion, of long, extensible and very strong lamellæ and filaments, which in fat persons enclose numerous adipose vesicles, forming a very elastic cushion. Laterally, we also observe filaments; but the lamellated disposition predominates, the fibrous form is less evident, and the adeps being no longer included in such compact cells, the adipose stratum then presents the same characters as in other parts of the body. In thin adults the subcutaneous layer forms a very distinct aponeurosis, which seems to arise from the linea alba, in order to produce the fascia superficialis. It contains but few nerves; small arteries and veins, however, are very abundant in it; phlegmonous abscesses are often developed in it, which may become very large, on account of its great thickness. It is a good situation for the establishment of a drain, and Mr. Dupuytren, among others, has derived great advantage from introducing a large seton into this tissue, in cases of chronic affections of the bladder, &c.

III. *The Aponeurosis.*

In the upper half of this region, the arrangement of the aponeurosis is similar to that of the umbilical region; inferiorly, it deserves a particular examination. Thus the conjoined aponeuroses of the external and internal oblique muscles, pass over the

anterior surface of the rectus muscle as far as the outer margin of the pyramidalis, where they split in order to form a sheath for this muscle, and again unite at the linea alba; but the transversalis and internal oblique muscles do not send a sheet behind the rectus at its inferior portion, not because the posterior sheath of the rectus is then sent before it, but because the transversalis muscle does not descend so low as the lower half of this region. Consequently, we may say that the aponeuroses of the two superficial muscular planes become blended, and pass over the anterior surface of the median muscle, in order to envelope the pyramidalis, and that posteriorly, the peritoneum is only separated from the muscles by cellular tissue or the *fascia propria*.

As to the linea alba, it becomes narrower in proportion to its thickness, and its fibres are more separated, or less compact, in proportion to their approximation to the pubis; but this disposition is subject to variations. Thus, during gestation, the linea alba is attenuated and expanded, and its fibres are even drawn asunder, so that the skin is separated from the peritoneum by the subcutaneous layer only. When this separation is renewed several times in succession, notwithstanding the cause which produced it has been removed, the belly remains enlarged, and its parietes are flaccid; so that, in subsequent pregnancies, the uterus may be anteverted over the pubes, to such a degree as to escape almost entirely from the pelvis, and produce an enormous ventral hernia of the womb, two remarkable examples of which are related by Sennertus, another by Rousset and a fourth by Ruysch. This separation, whether circumscribed or not, also predisposes, after parturition, to ventral herniæ of an elongated form, which are scarcely liable to strangulation. It also follows from this disposition that, in order to reach the peritoneum or bladder, in cutting for the stone above the pubes, the instrument must penetrate through a great depth of parts, and that it is not always easy to cut exactly upon the linea alba, on account of the approximation of the muscles; whilst in the cesarean section, whether there is separation or attenuation merely, the laminæ to be divided are reduced to the skin, the subcutaneous stratum which then forms but a simple sheet, and the aponeurosis which is also much attenuated.

IV. *The Muscles.*

The pyramidalis and inferior portion of the rectus are the only muscles which we have to examine.

We have to observe that the first is frequently wanting, again it is double or even triple, on one or both sides, and in certain cases these two muscles are so closely approximated, that there only exists between them, upon the median line, but a simple fibrous interstice; furthermore, they sometimes incline more to one side than the other, so that we cannot always avoid them in attempting to reach the bladder. They originate from the anterior and superior part of the pubes, and are prolonged almost to the umbilicus, by means of a small fibrous cord, through the medium of which they also act as tensors to the aponeurosis abdominalis. They are included in a distinct fibrous sheath, so that their contraction is entirely independent of the recti muscles. Their action, however, is of so little importance, that we need not fear cutting upon them.

The recti muscles are here much broader superiorly than inferiorly; in the former situation they do not differ materially from their umbilical portion; in the latter, on the contrary, each of them is transformed into a flattened tendon, about two inches broad, which becomes attenuated in its middle portion, in such a manner, that before it attaches itself to the bones, it is divided, as it were, into two bandelets, between which we conceive that the viscera might protrude when this part is very much weakened. Their internal margin is free, or rather it is blended with the linea alba; but posteriorly, they are removed from each other, upon the median line, by a small triangular *fossette*, the base of which corresponds to the symphysis pubis, and which is filled with some very loose cellular tissue. The external margin is thinner, and seems to transform itself into a fibro-cellular sheet, which is continuous with the internal portion of the fascia transversalis. The aponeurotic lamina which separates the rectus muscle from the pyramidalis is very thin; its anterior surface bears the same relations to the fibrous sheath as throughout the rest of its length, and its posterior surface is separated from the peritoneum merely by a cellular sheet of greater or less thick-

ness. A transverse division of the rectus muscle would be more dangerous here than higher up, because, on the one hand, it is, as it were, the only one in this region, which can act upon the pelvis; whilst, in the epigastric and umbilical regions, the broad muscles might in part fulfil its functions; on the other hand, because it is in the inferior portion of the abdomen that the efforts which tend to protrude the viscera act most energetically, and, therefore, if we do not pay the greatest attention to approximate the divided extremities of the muscle, the natural retraction of this organ would not fail to leave a very weak cicatrix, very much disposed to yield on the slightest exertion.

v. *The Arteries.*

The subcutaneous layer receives some of the ramifications of the epigastrica superficialis, and likewise some of the circumflexa ilii reach the superior part of this region; but the principal artery is the epigastrica profunda. This last artery, having turned under the cord, passes obliquely upwards and inwards, between the peritoneum and fascia transversalis, to the external edge of the rectus muscle, and gets behind it about two inches above the pubis; the trunk then continues to ascend in the direction of the fibres of this muscle, in the posterior plane of which it remains as far as the umbilical region, when the epigastric artery is still much nearer the external margin of the muscle than the median line.

The internal branches, given off by this trunk, are at least twice the size of the external. The latter immediately pass out of the hypogastric region; the former, on the contrary, are lost in it entirely; the direction of both is transverse; the greater proportion ramify in the rectus, and even pass through it as well as the pyramidalis, in order to reach the skin, and anastomose very freely with each other and with those of the opposite side, forming a certain number of loops, along the median line, between the peritoneum and the fibrous cord which constitutes the linea alba. The first two internal branches merit particular attention in regard to herniæ, especially near their origins, and in this respect shall be examined in the iliac region when we come to speak of the epigastric trunk. We will merely ob-

serve here, that when these two arteries have got behind the rectus, they cross its posterior surface, and anastomose with those of the opposite side in such a manner as to produce two flaccid arches, one of which follows the superior contour of the pelvis, whilst the other is found nearly an inch above it; so that, in a hernia which has protruded through a separation of the inferior part of the rectus abdominis muscle, the parts will be surrounded by a more or less complete arterial circle, and if the hernia is internal, as we call it, that is to say, if the displacement has occurred between the external margin of the tendon of this muscle and the trunk of the epigastric, this circle will be more voluminous and will render the division of the stricture more dangerous; but this is not the place to treat fully of these matters.

From what has just been said it follows that, in operating upon the hypogastric region, we run no risk of wounding the principal arteries, unless we penetrate to the posterior surface of the recti muscles; that, in this case even, if the incisions are parallel to the axis of the body or slightly oblique outwards, we would only wound the secondary branches, which will pour out a smaller quantity of blood in proportion to their proximity to the median region; that, if the division of the parts is transversal, we will also avoid the epigastric trunk, unless we touch the point where the external third unites with the two internal thirds of the muscle, in the superior part, and directly external to it, if we incise two or three inches above the pelvis.

In all cases, when the relative positions are changed, the whole are changed; thus, in pregnancy, in ascites, etc., the epigastric artery is sometimes removed to a considerable distance from the median line; but this is owing to the median fibrous cord being flattened, attenuated, and drawn out to the breadth of one, two, three and even four inches; the muscles also are pressed further upon the sides; the artery has followed them, but it will always be found in the same relations with their dimension; from which circumstance this disposition should be recollected, especially in paracentesis. It will likewise be of much importance to bear this in mind when we have decided upon performing the cesarean operation, after the common method; in fact.

when this operation becomes necessary, the rectus muscle is, as it were, expanded into a membrane, and its external margin is drawn four, five, and sometimes even six inches from the linea alba; the artery has necessarily followed this deviation, and consequently, if we wish to leave it on the inner side, the incision must be made very far upon the lateral part of the abdomen; if on the contrary, we leave it externally, as we are obliged to divide the tissues very close to it, almost all of the large branches which originate from it will necessarily be cut across.

VI. *The Veins.*

We find in this region a certain number of subcutaneous veins, which are much larger than the arteries of the same order during gestation, and when the circulation through the large abdominal trunks is interrupted in any manner whatsoever. They are susceptible of becoming varicose, and, in aged women or those who have borne many children, they sometimes produce *vergetures*, which almost always persist during the remainder of life, when they have once appeared.

The other veins are the epigastric, of which there are two, one on each side of the artery, and situated nearer to the external surface of the peritoneum than the latter. They are disposed in such a manner that they may become compressed by the womb during pregnancy, so as to obstruct the flow of blood through them and occasion their tumefaction.

VII. *The Lymphatics.*

The lymphatic vessels of the superficial set pass to the subcutaneous inguinal glands: those of the deep stratum descend into the pelvis; whence it follows that, when we wish to act upon buboes in the groin, we may apply mercurial frictions upon the skin of the hypogastrium, and that diseases of the latter point may produce sympathetic affections in the superior fold of the thigh. whilst deep-seated inflammations, or abscesses, are most liable to react upon the abdominal lymphatic glands.

VIII. *The Nerves.*

These organs are very few in number, very delicate, and scarcely perceptible; they come from the lumbar plexus and from the last intercostal nerve.

IX. *The Cellular Tissue.*

It constitutes one of the most important parts for consideration in the hypogastric region, as well on account of its arrangement as its quantity. In the first place, we have seen that, under the skin, it formed a thick and dense layer, which is directly continuous with the cellular tissue of the surrounding regions, and in such a manner as to permit purulent collections to penetrate from one point to another; next, in the sheath of the pyramidalis muscle, it is supple, delicate, destitute of fat, and may become the seat of inflammation or abscess, without the parts surrounding this species of sac participating at all in these affections. In the fibrous canal of the rectus muscle, the cellular tissue is also very lax, especially superiorly and laterally; but we must note that it forms two layers, one anterior, which is pretty thick inferiorly, where it is prolonged between the fascia transversalis and the obliquus internus; the other, posterior, which only communicates with the former in the superior half of the region, and which afterwards descends into the pelvis, in sliding between the rectus muscle and peritoneum, in order to lose itself in the fascia propria.

It is in consequence of this arrangement, that fluids accumulated in this sheath will make their way into the abdomen more readily when the collection is made in the upper part of the hypogastrium, than when it is seated in the inferior half of this region. Finally, the musculo-peritoneal layer is dense at the superior part; inferiorly and laterally, it is supple and thicker; externally it separates the peritoneum from the fascia transversalis; upon the median line it is still more abundant, its lamellæ are then very much separated, and the cellular element alone fills up the slight depression which exists between the recti muscles and the upper part of the pubes. We may here remark.

further, that this slight excavation becomes obliterated during pregnancy, and then the margin of the pelvis forms a greater or less projection internally; whence it follows that in drawing the child by the feet, during labour, when the face is turned forwards, it is actually possible, if we do not attend to the uterine contractions, to hitch the chin upon the pubes. It is this point of the cellular layer which corresponds to the bladder when this reservoir is distended with urine, and it is here that inflammation is most frequently developed, after the high operation for the stone: therefore, as this layer becomes more and more lax in proportion to its descent into the pelvis, it thence follows that pathological products and urine will readily infiltrate into it, when we perform this operation, or even after the simple puncture of the bladder.

The following is the relative disposition of the parts according to their order of superposition upon the median line:

We have to consider, 1st, the skin, covered with hairs as high as the upper part of the region in man, inferiorly only in woman; 2d, a very thick fibrous and adipo-cellular layer, principally cellular at the inferior part; 3d, the linea alba, considerably narrower below, and the fibres of which then separate and become rarefied anteriorly, as if to give origin to the superficial fascia; 4th, inferiorly, the supra-pubal depression filled with cellular tissue and adipose vesicles; more superiorly the urachus and also the cellular layer; 5th, finally, the peritoneum or the anterior surface of the bladder. No important artery is met with in this situation.

Upon the lateral parts we find: 1st, the skin, almost always destitute of hairs in females, except at the lower portion; 2d, the subcutaneous layer, including much fat, and in which we find the superficial veins, and the twigs of the superficial epigastric artery; 3d, The anterior sheet of the aponeurosis, composed of a lamina of the obliquus externus and another of the obliquus internus; near the symphysis of the pubis, a thin layer of cellular tissue, between this last sheet and the pyramidalis muscle; this muscle itself, a second cellular layer similar to the former, then a fibrous plate immediately applied upon the fore part of the rectus muscle; 4th, the cellular tissue, placed upon the rectus abdominis muscle and slightly adherent to the aponeurosis; 5th, this muscle, with one of its intersections; 6th, another cellular

lamina, which is prolonged without interruption into the umbilical region ; 7th, the posterior sheet of the aponeurosis, complete above, replaced below by the origin of the fascia transversalis ; 8th, the cellular covering of the peritoneum ; 9th, and lastly, the peritoneum itself.

Sect. 2. Iliac Regions.

The iliac regions are almost triangular in their form, and are situated on each side of the hypogastrium : they are bounded, superiorly, by the sub-umbilical line ; internally, by the external margin of the rectus abdominis muscle ; externally and inferiorly, by a slightly curved line, with an inferior and external convexity, which extends from the anterior and superior spinous process of the os ilium to the tubercle of the pubis, which, in a word, follows the direction of Poupart's ligament : these two regions presenting the same elements and the same arrangement, what we say of one will necessarily apply to the other.

The surface of the iliac region varies only as it respects the degree of prominence which it forms ; in very thin subjects, or those who have fallen into a state of marasmus in consequence of lingering diseases, it is generally excavated, and Poupart's ligament then forms a very distinct ridge ; whereas, in obesity, pregnancy, ascites and other diseases of the abdomen which distend its parietes, its anterior prominence is very much augmented. In women who have had a numerous progeny, and in those whose embonpoint has been reduced in any manner whatsoever, it frequently presents a kind of bulging, formed by the skin and adipo-cellular tissue ; a bulging or duplicature which descends so as almost to conceal the fold of the groin, sometimes producing excoriations and exudations, in consequence of the friction of the two contiguous surfaces.

CONSTITUENT PARTS.

1. The Skin.

Its characters are the same as in the hypogastric region, with the exception that it does not contain so many sebaceous follicles and

is not covered with so great a quantity of hairs ; in women it is quite destitute in the latter, and in men also, in the external half of its extent. As for the rest, it is delicate, shining, white and extensible, much wrinkled after repeated pregnancies, and very frequently presenting venous *vergetures*.

II. *The Subcutaneous Layer.*

This layer, which has of late been the subject of very particular attention, may be easily split into several laminae. Its external laminae enclose adipose vesicles, which consequently separate them more or less from each other according to the *embon-point* or emaciation of the subject ; in this manner they form a species of cellulo-adipose cushion, the thickness of which is extremely variable, and which always passes before the crural arch, without adhering to it, in order to become continuous with the subcutaneous tissue of the thigh. Its posterior or deep seated lamellæ are sometimes very close, compact, and intimately adherent to each other, constituting a complete aponeurosis ; at other times they are, as it were, rarefied, presenting the appearance of a single lamellated layer destitute of fatty cells. It is this posterior portion of the subcutaneous layer which was first described by Camper as a distinct membrane, afterwards called by Scarpa, the fibrous expansion of the fascia lata, and generally known at the present day by the name of *Fascia Superficialis*. We have already said that this fascia existed over the whole surface of the body, but that it was stronger and better delineated upon the inferior part of the abdomen. It gradually increases in thickness as it passes towards the pubis, to which it adheres as well as to the linea alba, as was mentioned when speaking of the hypogastric region ; and, as it passes over Poupart's ligament, it also forms a slight attachment to this fibrous ribband. Between the *Fascia Superficialis* and the aponeurosis of the external oblique, there is a third cellular layer, which is delicate, lamellated, more supple, and more easily distended than the two preceding ; so that fluids collected beneath it may become extensively diffused through the surrounding regions.

III. *The Aponeurosis.*

If we carefully remove the fascia superficialis we will completely expose the aponeurosis of the external oblique muscle, which is of a pearly hue, opaque and entirely obscures the muscular structure which is situated beneath it. It is of greater strength here than throughout the rest of its extent, and consists of two orders of fibres, one of which runs in the primitive direction of the muscular fibres, that is obliquely downwards and inwards; they are almost always arranged in more or less distinct *bandelets*, which are more separate internally than externally, exposing between them the fleshy tissue of the obliquus internus muscle. This separation is sometimes one and even several lines, especially inferiorly; which then causes such an attenuation of the aponeurosis at this part, that the viscera may be protruded through it, so as to form a species of oblong tumour above the groin, which tumour might be ranked in the class of ventral herniæ, and which should be carefully distinguished from inguinal ruptures. One of these *bandelets*, much stronger and denser than all the others, passes from the anterior and superior spinous process of the os ilii to the tubercle of the pubis, and thus forms what we would call the *ilio-pubic bandelet* of the obliquus externus: it is also known by the names of the crural arch, Fallopius' or Poupart's ligament. In order that it may be more conveniently studied, we will consider it as possessing three borders: first, the *femoral*, which is inferior and anterior, and is continuous with the superficial sheet of the fascia lata; second, the *abdominal*, which is anterior and superior, and is continuous without any very distinct line of demarcation with the *bandelets* previously spoken of, which fall obliquely upon it until within about two inches, or an inch and a half only, of the symphysis pubis. At this place, the superior *bandelets*, which appertain to the aponeurosis of the obliquus externus muscle, and Fallopius ligament properly so called, separate in such a manner, that the former pass above the spermatic cord in the male, and the round ligament of the uterus in the female, in order to become attached to the fore part of the body of the os pubis, intersecting with similar *bandelets* of the opposite side upon the anterior face of the sym-

physis, whilst the second slides beneath these parts and is inserted into the tubercle of the os pubis. In consequence of this separation, a triangular aperture is formed, which constitutes the external orifice of the inguinal canal, or simply the *inguinal ring*, which surrounds the spermatic cord or round ligament, according to the sex, and is the place through which herniæ are most frequently formed in the male. The *bandelet* which circumscribes this opening superiorly, has received the name of internal, anterior, or superior pillar of the ring; that which constitutes its inferior border is called the external, posterior or interior pillar of the ring. We shall recur to this before we have done with this region. Finally, the third border of Poupart's ligament is superior and posterior or *pelvic*: it is this which gives origin to the fascia transversalis; near its iliac extremity, it is blended with the abdominal border; but in proportion as these two borders remove from the spine of the ilium, they separate from each other in such a manner that they form a complete gutter, which gradually increases in breadth and depth as we approximate the inguinal ring, and into which some fibres of the external oblique muscle are implanted: some nervous filaments, the spermatic cord, etc., run through this gutter, as we will see hereafter.

The fibres of the second order of the aponeurosis of the external oblique are very few in number, and are so arranged that, without them the preceding would form only a simple warp, whilst with them, the aponeurosis represents a complete tissue; that is to say, that they cross them at right angles, and only differ from them by their small number. In fact, they evidently appertain to the same layer which we have observed in the epigastric and umbilical regions, which ran in an oblique direction from above downwards and from within outwards. Only these fibres become less numerous as they descend, so that they are lost as it were, in the region under consideration, in the very thin fibro-cellular web upon which they are delineated. They are much more strongly marked in the adult male than in childhood or in the female, and especially where they approximate the ring, or the separation of its two pillars, the size of which they diminish considerably by rounding off its external and superior angle: in this situation, these fibres become blended with the web just mentioned, and are prolonged upon the cord. form-

ing a sheath for it, which will be more appropriately examined hereafter.

Before the aponeurosis of the external oblique enters the hypogastric region, its posterior surface receives that of the internal oblique, which is still distinct above, and serves as a point of insertion to the fibres of this muscle below.

We may now examine the *fascia transversalis*. This lamina so named by Sir A. Cooper,* and more precisely described by M. J. Cloquet, originates from the pelvic border of the crural (Poupart's) ligament, or rather prolongs this border, first between the internal oblique and peritoneum, then between the peritoneum and transversalis muscle; it also arises from the internal labium of the crista of the ilium, and contracts the same relations with the transversalis; it also derives its origin from the external tendinous margin of the rectus muscle; or, in other words, it is at first expanded and blended with the cellular tissue, between the serous membrane and muscles of the belly, throughout the whole extent of the parietes of this cavity, in such a manner as to repeat, internally, the fascia superficialis, passing upwards to join the lamellated tissue which lines the sub-diaphragmatic peritoneum. Afterwards, as it descends, it becomes more and more isolated, seems to supply the place of the aponeurosis of the transversalis, by attaching itself to the external margin of the rectus muscle, instead of passing behind it, and goes to be inserted into the whole length of the posterior border of Poupart's ligament, as well as upon the internal part of the crista ilii. It is principally from these latter points to the extent of two or three inches above them, that the fascia transversalis presents aponeurotic characters, but in a very variable manner, however; one inch above, and external to the external iliac artery, it is traversed by the spermatic cord, and when this fascia is very strong, this aperture, which constitutes the internal, abdominal, or superior orifice of the inguinal canal, is remarkable for its resemblance to the ring of the external oblique. It divides the *fascia transversalis* into internal and external portions. The internal portion, fixed upon the posterior border of the body of the pubis and of the external pillar of the ring, is generally very strong, and formed of

* On Inguinal and Congenital Hernia, plate 1.

fibres which ascend parallel to the direction of the external margin of the rectus muscle, of which they are an appendage, and pass, in this manner, obliquely upwards and outwards. The fibres of the second, abandoning the pelvic border of the *ilio-pubic bandelet*, take an inward course, as if to go to the umbilicus, so that they intersect the former about twelve or fifteen lines above Poupart's ligament, in such a manner as to leave between them a triangular or almost oval space, which is broader below than above, and the plane of which looks upwards and outwards. This fibrous appearance is not always evident, and the fascia transversalis sometimes represents an uniform web, without distinct fibres; in all cases, its opening no more exists in reality than that which forms the inguinal ring; that is to say, that each of these orifices send upon the cord an expansion which prolongs the two aponeuroses to the scrotum. Lastly, the aperture under examination, like that of the obliquus externus, is, in certain cases, completely triangular and very much enlarged by the elongation of its superior angle; then the said two bandelets remain almost entirely separate, and it is doubtless for this reason that different anatomists vary their description of this fascia, the arrangement of which is actually much more simple than has been generally supposed. In fact, it is only complicated in consequence of the varieties in its thickness, and of its adhesion to the laminæ between which it is placed; but, in order to form a clear idea of it, it is sufficient to recollect that it bears a pretty exact resemblance, between the peritoneum and muscles, to the aponeurosis of the external oblique between these same muscles and the skin. We will have occasion to revert to its relations, when passing in review the different tissues which remain to be examined, and especially when describing the inguinal canal.

IV. *The Muscles.*

All that we have to consider here is a small portion of the internal oblique and transversalis muscles. The first is formed of diverging fibres which originate, by their ilial extremity, from the gutter of the crural ligament, and run to terminate upon the external aponeurosis, external to the rectus muscle: the superior

take a transverse course, the inferior run obliquely, or form gentle curvatures, having an external and anterior convexity. Near the ring, they become more pale, cross the anterior surface of the cord, and give rise to the cremaster, which muscle is nothing more than a series of muscular arcs produced by the *tractions* of the testicle upon the inferior fasciculi of the internal oblique. Hesselbach* is one of the first who noticed that such was the arrangement of the cremaster muscle; but it is to M. J. Cloquet that we are indebted for its demonstration. Scarpa states that it is constant,† and we have always met with it upon the dead body. In order to be convinced of it, it is necessary to reflect the aponeurosis of the external oblique from within outwards, after having divided the internal pillar of the ring: then, if we seize the cord and draw it gently forwards, we will readily perceive that fleshy semi-circles cover its anterior surface, which semi-circles are derived from the internal oblique, and that they are attached by their two extremities to the two sides of the internal circumference of the ring. These fibres are usually so slender, and so indistinct where they are attached to the pubis, near the rectus muscle, that several very exact modern anatomists seem to doubt their existence on the inner side of the cord, and continue to consider them as fasciculi detached from the internal oblique muscle, which are expanded in a membranous form upon the anterior, posterior and especially the external parts, in such a manner as to form a simple web around the spermatic cord; but, by taking the precaution just indicated, it will always be possible, if we follow the different fasciculi of the internal oblique muscle, to see that the fibres are almost straight from the crural gutter to the pubis; that they afterwards become gradually curved as they descend, so as to form loops more and more elongated, which imperceptibly disappear after leaving the ring. In this examination, we must trace the muscular fibres from their external towards their internal extremity, and we will find that they are much more numerous anteriorly than posteriorly, where they do not always exist. In short, if we carry our imagination back to the epoch of birth, when the testicles are

*De ortu et Progressu Herniarum. Wicæbergæ 1816, page 17.

† Supplement to Treatise on Herniæ, etc.

still behind the ring, we will readily conceive that this gland, drawn down by the gubernaculum testis, and meeting with the posterior surface of the internal oblique opposing its passage, will propel its fibres through the external orifice of the inguinal canal, and will draw them into the scrotum, leaving their extremities in their original situation. Finally, subjects who have been long afflicted with large scrotal herniæ afford the best examples for the study of the cremaster.

The iliac portion of the transversalis also arises from the external fourth part of the crural gutter, and the internal labium of the spine of the ilium. The direction of its fibres, in this region, are horizontal; the superior readily detached from the internal oblique, but the inferior so intimately blended with it, that it is almost impossible to tell whether they do not concur in the formation of the cremaster. From our own dissections, we are induced to think that they entirely disappear inferiorly, and that the middle muscular stratum of the abdominal parietes alone is situated before the cord and fascia transversalis, to the extent of about an inch above the pubis and the internal half of Poupart's ligament. It is, however, of little importance to the surgeon to know whether the fibres of the transversalis are actually prolonged into the ring with those of the internal oblique, or whether the latter only are engaged in it. The first of these planes is always blended with the other towards its termination, and as the latter is the only one which we distinguish inferiorly, it seems to us that the cremaster must appertain to it altogether.

v. *The Arteries.*

The subcutaneous of the abdomen (*epigastrica superficialis*), the epigastric and circumflex iliac arteries take their course through this region. The superficial epigastric originates from the femoral just as it enters the inguinal region; the two others arise from the external iliac, previous to its exit from the pelvis; but we will only examine these arteries from the point where they leave Poupart's ligament, being obliged to attend to their origin in other regions.

(a) The *epigastrica superficialis* runs under the integuments, in the superficial fascia, lying nearer the aponeurosis of the ex-

ternal oblique than the skin. It enters into the iliac region on crossing the middle of Poupart's ligament, and ascends into the epigastric region, where it anastomoses with the superficial branches of the deep-seated epigastric and internal mammary arteries. In its course, it gives off many small and unimportant lateral branches; the trunk itself is seldom so large as to merit much attention, but at other times, it is of considerable volume, and will necessarily be divided in the operation for taking up the external iliac artery, whether the incision be made in the direction of the crural arch, or obliquely from above downwards and from without inwards, unless, by anomaly, it runs very near the spine of the ilium. It is probable that a lesion of this artery has occasionally been mistaken for a wound of the deep-seated epigastric. Whenever it is divided it should be secured immediately, otherwise it will retract within the cellular tissue, and thereby render its detection difficult after the operation is completed. It will always be found situated between the deep-seated layers of the fascia superficialis.

(b) The second, or epigastric (*sus-pubienne, Ch.*), on entering this region, is situated upon the internal semi-circumference of the opening of the *fascia transversalis*, or abdominal orifice of the inguinal canal; so that, in herniæ protruding through this aperture, the pubic side of the neck of the sac is embraced by an arterial semi-circle, formed by the trunk of the epigastric artery. It ascends in a slightly oblique direction into the hypogastric region, where it perforates the *fascia transversalis*, below the point where the aponeurosis of the transverse muscle ceases to be distinct, in order to pass between the rectus muscle and the posterior sheet of its fibrous sheath. Behind Poupart's ligament, immediately below and within the spermatic cord, the epigastric artery gives off three small, but important branches, which also, occasionally, arise by a single trunk. The first comes from its concavity, immediately inclines upwards and outwards, enters the inguinal canal and follows the testicular cord. The second re-descends, runs along the posterior face of Gimbernat's ligament, sends off a twig to the crural canal, and afterwards anastomoses with the obturator artery. We will speak further of this *arteriola* when we examine the iliac fossa. The third is applied upon the posterior surface of the *ilio-pubic* (Poupart's) ligament, takes

a transverse course behind the body of the pubis as far as the symphysis, where it unites in the form of an arch with its fellow of the opposite side. Sometimes this branch arises from the epigastric a half inch and even an inch above the point just mentioned; in this case it crosses the rectus muscle, and does not place itself behind the pubis until it reaches the median line. It is occasionally so large that we should be careful to avoid wounding it, an occurrence which might take place under two different circumstances: 1st, when it is given off from the epigastric trunk below the spermatic cord; then, if a crural hernia forms, this branch will embrace the superior part of the neck of the tumour, and if we cut upwards, in dilating the stricture, it will consequently be divided. 2d, If, on the contrary, it originates much higher up, and a direct inguinal hernia (*hernie interne*) takes place, that is to say, if the viscera protrude on the pubic side of the cord and epigastric artery, the same arterial branch will also run over the superior half of the neck of the sac, and then the division of the stricture would be as dangerous upwards, or inwards as outwards. Immediately above the crural arch, the epigastric artery is about six lines nearer the pubis than to the anterior and superior spinous process of the ilium. It is convex downwards, inwards and forwards, where it rests upon the posterior surface of the fascia transversalis, to which it is usually fixed by a pretty supple cellular tissue; outwards and backwards it is concave, and separated from the peritoneum by a stronger cellular expansion which appertains to the *fascia propria*. Externally it turns under the spermatic cord, at the moment of its entrance into the inguinal canal; finally, notwithstanding the umbilical (*hypogastric*) artery runs along its inner side, it is always so remote from it that herniæ may protrude between the two vessels.

According to these relations we see, that, if we wished to tie the epigastric artery as M. Bogros has proposed, in those cases wherein it may have been wounded, as sometimes happens in the operation of paracentesis abdominis, strangulated hernia, ligature of the external iliac artery, or in consequence of wounds penetrating the abdomen, we would discover it with certainty and facility, by making an incision through the skin about two inches in length and parallel to the direction of Poupart's ligament, afterwards dividing the aponeurosis of the external oblique upon a grooved

director; next by raising and separating the inferior fibres of the internal oblique muscle, when the spermatic cord will present itself to view; we must now trace the superior surface of the latter, which will soon carry us to the aperture in the fascia transversalis, upon the posterior surface of which the artery is always applied, which being torn with the director, or incised with the bistoury, will lay bare the vessel, enveloped in a tissue which is sometimes of considerable density and accompanied by its two collateral veins. Unfortunately this operation can be seldom applied to those cases which would seem to demand it; in fact, if the epigastric artery is wounded in one of the cases just mentioned, the surgeon does not generally detect it at first, the hæmorrhage not taking place outwardly, indeed, there is no certainty of its existence until the severity of the symptoms renders every kind of operation useless, or until sufficient blood has been extravasated to destroy the patient by exciting peritonitis, even when the artery shall have been tied but a short time after the occurrence of the accident.

(c) We have, in a very few instances, observed a second artery similar to the preceding, but generally smaller, coming off from the trunk of the external iliac, running upon the external side of the abdominal aperture of the inguinal canal, and ascending obliquely outwards between the peritoneum and the fascia transversalis. Sometimes also this branch arises much lower down, and takes the same direction; but then it may remain in the deep laminæ of the fascia superficialis as M. F. Meckel has observed.* In either case it might be divided, in strangulated inguinal hernia, by dilating the stricture upwards and outwards.

(d) The trunk of the circumflex iliac artery appertains to the fossa iliaca; its external and anterior branches only belong to this region; at first they run between the external oblique and transversalis muscles, and afterwards ramify in the two obliqui, when they enter the regions of the flank and umbilicus. They are generally small; but it may happen that one of the branches nearest the rectus muscle shall be so large as to occasion a dangerous hæmorrhage, if wounded in the operation of paracentesis. Ramsay† has related a very remarkable case of this kind.

* Manuel d'Anatomie, etc. tome 2. page 464.

† Med. and Surg. Jour. Vol. 3. page 280.

VI. *The Veins.*

The veins of the iliac region receive almost all those of the hypogastric and umbilical regions and follow the distribution of the arteries.

The *subcutaneous veins* greatly surpass in size the superficial epigastric artery, and each of their branches exceed in volume the trunk of the latter. We sometimes meet with two, three, four, and even a greater number; now and then they become enormously dilated, intersect one another in a thousand ways, and form a complicated net-work over the sub-umbilical portion of the abdomen, giving, in such cases, a blackish or livid appearance, and knotty indurated feeling to the integuments. This varicose state of the superficial veins is generally accompanied with a similar disposition in those of the inferior extremities. Such were the cases related by M. Severin*, who compared the belly of his patient to a Medusa's head, and M. Boyer, in whose patient the legs were covered with varices. These occurrences are generally dependant upon pregnancy, and are therefore only of a temporary nature. Be this as it may, these nodi, or venous plexus may cause considerable embarrassment in the cesarean section, the operations for aneurisms, hernia, &c., and might possibly, from a superficial examination, be mistaken for one of the two last mentioned diseases. Finally, these veins may become inflamed, and we have recently met with a woman, six months and a half advanced in pregnancy, in whom they were of a vivid red, tense, enlarged and extremely painful: the veins of the ham and of the posterior part of the right thigh were in a similar condition.

There are generally two *venæ comites* to the epigastric artery, to which they are connected by means of a compact cellular sheath, so that it is not always easy to separate them: they anastomose freely with each other behind the artery. The iliac vein into which they empty their blood is situated on the inner side of the artery, in consequence of which they form only a slight curve near their origin; but they may be drawn forwards by the neck of

* De natura Abscessuum recond. cap. x.

an oblique inguinal hernia, which, when very large, may so compress them as to occasion their varicose dilatation.

VII. *The Lymphatics.*

All of the superficial lymphatic vessels pass to the inguinal glands, whilst those which are deep seated take their course to the fossa iliaca or pelvis. There is no absorbent gland met with in this section of the abdominal parietes; at least, we do not find any between the aponeurosis and the skin, nor between the peritoneum and the deep seated fascia; but sometimes there is one in the inguinal canal, which deserves particular attention on account of the errors to which it might give rise; it is probable, however, that in those cases wherein surgeons have detected a gland in this canal, that this was not its original situation, but that it is one of those which surround the spermatic opening in the fascia transversalis, which has become displaced, or protruded into it in consequence of some morbid tumefaction. Be this as it may, it is evident that, if this gland inflames, it may give rise to serious consequences, and, as it enlarges, may be mistaken for a bubonocoele, a cyst of the cord, or for the testicle, if this organ has not yet descended into the scrotum.

VIII. *The Nerves.*

They are furnished by the lumbar plexus, and principally by the ilio-scrotal and genito-crural branches.

The *ilio-scrotal** is at first situated between the peritoneum and transversalis, then passes through the fibres of this muscle, follows the spine of the ilium, runs along the gutter of the crural arch, perforates the obliquus internus before it arrives at the ring, through which it passes in order to be distributed to the scrotum. The genito-crural comes from the iliac fossa and enters with the cord into the inguinal canal; so that there are two distinct nerves in the spermatic cord; and in order to distinguish them, it is sufficient to recollect that the branch of the genito-crural is internal and posterior, whilst that of the ilio-scrotal is external and anterior, that the latter is situated between the cremas-

* Superior musculo-cutaneous branch of the lumbar plexus.

ter muscle and the cellular sheath, whilst the former, is in the laminae of the tunica propria of the cord.

We also find near the spinous process of the os ilii some twigs of the inguino-cutaneous nerve;* but the only important ones in surgery are the two preceding, they being more or less concerned in the operations for hernia, hydrocele, varicocele, cancer, etc.

IX. *The Cellular Tissue.*

Between the internal oblique muscle and the external aponeurosis, the cellular tissue forms a delicate and slightly adherent lamellated membrane, which is more abundant near Poupart's ligament, and especially in the vicinity of the ring, where it sometimes contains a considerable number of large, soft, adipose vesicles, and is prolonged upon the tunica erythroides of the cord. There is also another layer between the transversalis and internal oblique muscles, which is always very thin, and only communicates with the former through the medium of the cellular tissue of the fascia transversalis, and the cellulous sheaths of the muscular fibres. The lamellæ which unite the fascia transversalis to the muscles, constitute a third layer, which is dense and compact superiorly, looser and more extensible the nearer we approach the abdominal aperture of the canal, into which it insinuates itself, covering the external surface of the tunica propria of the cord. It is still more supple on the inner side of this aperture, between the internal portion of the fascia transversalis and the fibres of the obliquus internus muscle, among which it is rarefied in order to blend itself with the first sub-aponeurotic layer; so that we find behind the inguinal ring, the cellular tissue supple and in great abundance, the fleshy fibres very soft and lacerable; circumstances to be recollected when we operate for strangulated hernia, or when abscesses form in the inguinal canal. Finally, a fourth layer unites the peritoneum to the fascia transversalis. We have met with it in all the abdominal regions, it is true; but in no part does it merit so much attention as in the iliac region. Superiorly, it adheres very firmly to the two membranes between which it is situated, so that it is difficult to separate it from the

* Inferior musculo-cutaneous branch of the lumbar plexus.—*Transl*

peritoneum without lacerating it; inferiorly, and behind the rectus muscle, it supplies the place of the aponeurosis of the transversalis muscle, and communicates with the cellular tissue of the sheath of the former of these muscles. Near and posterior to Poupart's ligament, it is also supple and very thick, forming a complete membrane, which gives a sheath to the epigastric vessels and the umbilical artery, is spread over the peritoneum, penetrates into the inguinal canal, and becomes blended with the tunic, which, after it is detached from the margin of the opening in the fascia transversalis, forms the proper envelope of the cord. This membrane is generally so distinct and strong, that it has been thought proper to make of it a particular aponeurosis, which is called the *fascia propria*, and which, in these cases, may also be considered as separated from the fascia transversalis on the one hand, and the peritoneum on the other, by supple and extensible cellulous lamellæ. It is not unusual to see it stronger and more decidedly fibrous than the fascia transversalis itself; and, in consequence of this arrangement of structure, we may explain how it is that some anatomists have affirmed that the fascia transversalis is prolonged behind the rectus muscle and descends into the iliac fossa. Here, as well as elsewhere, this layer sometimes encloses adipose vesicles, which are attached to the external surface of the peritoneum by means of a pedicle; and these are the kind of appendices, inordinately enlarged, which almost always form fatty herniæ in the inguinal region, similar to those of the regions which have been examined. Now that the different strata of the iliac region are known to us, we are prepared for the investigation of the *inguinal canal*.

x. *The Inguinal Canal.*

By this name we denote that passage through which the spermatic cord runs, in traversing the abdominal parietes. Its direction is oblique from above downwards, from without inwards, and from behind forwards. Considered as a canal, it is about two inches in length; the distance from the internal part of its inguinal aperture to the external part of its abdominal orifice, is three inches, and from the latter to the antero-superior spinous process of the ilium, about two inches. Its external and ante-

rior paries is formed by some fibres of the internal oblique and the aponeurosis of the external oblique : this is the strongest, and should be so, because it is against it that those efforts which tend to protrude the viscera are concentrated. Externally, it is continuous with the wall of the abdomen ; so that from the os ilii to the ring, properly so called, it may become attenuated, distended, and permit the organs situated behind it to project externally, forming a species of ventral hernia ; a hernia which will not become strangulated, so long as the parts have not passed through the external orifice of the canal. Its posterior or internal paries is constituted by the internal portion of the fascia transversalis and by cellular tissue, and is thicker and stronger, the nearer it approximates the pubis. The posterior surface of this wall may be divided into three portions ; the first, which is of very small extent, is comprised between the posterior aperture of the canal and the epigastric artery, and makes a part of the external inguinal *fossette*, or excavation. Whenever the viscera insinuate themselves into this part, in order to form a hernia, the tumour is called *external (oblique) inguinal hernia*. The second is bounded by the epigastric artery externally, and by the umbilical artery internally, and corresponds to the internal inguinal *fossette*; and when the organs make their escape at this point, they commence by compressing the two walls of the canal together, and afterwards take an almost direct course forwards through the external ring : the protrusion then takes the name of *internal (direct) inguinal hernia*. Finally, the third extends from the umbilical artery to the external margin of the tendon of the rectus muscle, and forms the floor of a small triangular cavity through which the intestines may likewise penetrate : in this case, the viscera must incline slightly outwards, in order to escape by the external orifice ; otherwise, they will press against the posterior aspect of the internal pillar, and will not be able to escape, unless through a rent in the fibres which compose this *bandelet*.

Strictly speaking, there is no superior wall to the inguinal canal, or at least it is only formed by those fibres of the internal oblique muscle which fill up the space between the anterior aponeurosis and the fascia transversalis. It is important to keep in mind, that the cellular tissue which connects these parts is

supple and very extensible. Indeed, if we did not pay attention to this circumstance, when attempting the reduction of a hernia, we might detach these two membranes and push the posterior one very far into the abdominal paries, and thereby dispose to the following unpleasant consequences :

Inflammation excited by the forcible separation or perforation of the muscular stratum and the cellular tissue which unites it to the fibrous laminæ, notwithstanding the protruded parts might have been eventually reduced. This inflammation would be quickly followed by the formation of a great quantity of pus, more especially as the cellular tissue is very lax and abundant in this situation : a vast abscess would be the consequence of this accident ; and as the posterior wall of this abscess is much thinner and less unyielding than the anterior, the matter may perforate it and escape into the abdominal cavity, or may find a natural issue, if I may so say, through the opening in the fascia transversalis.

Or, on the contrary, a species of pouch may be formed in this manner, in which the organs might be abandoned by the surgeon, he thinking that the reduction is accomplished. In this case, in addition to the consequences just related, if the internal ring was the seat of the stricture, symptoms of strangulation would continue, and soon produce the death of the patient.

The former of these two circumstances occurred to us, in the presence of thirty medical gentlemen and students, at the close of the summer of 1824. We operated upon a man twenty-eight years of age, who had a very large hernia, which had been strangulated three days. The sac being opened to the bottom, the testicle was exposed, and, in the same bag, a loop of small intestine, about eighteen inches long : the ring was not very rigid ; nevertheless, we could not return the parts. We dilated extensively, still the reduction was not much more easy ; however, we thought that it was accomplished ; that is to say, we succeeded in pushing almost the whole of the prolapsed intestine behind the external orifice ; but we could not return the rest, and when the pressure was removed, it was again prolapsed. We could now introduce the finger into the ring, and distinguished a large cavity, which extended in every direction, and at the same time perceived that the seat of the stricture was at the

internal orifice. Having divided the stricture at this point, we easily returned all the parts. During two days, the state of the patient remained doubtful; on the third, the alvine evacuations were profuse and he was decidedly better; but a local affection soon manifested itself. Eight days subsequent to this period, we ascertained that a large abscess existed in the substance of the abdominal paries, above Poupart's ligament, and between the aponeuroses: we opened it, and a pound of pus was evacuated. Before this secretion had entirely ceased, which was effected in three weeks, another abscess had formed in the scrotum; this was also opened, and was found to communicate with that of the iliac region. The individual was completely restored.

Inferiorly, the inguinal canal is formed by the gutter of Poupart's ligament, which is broader near the ring of the external oblique than where it approximates the os ilium. In the former direction, this gutter is nearly five lines in breadth, whilst, in the second, it is transformed into a simple border. This is the strongest paries, and the cord almost always lies upon it in hernia, even in the direct species.

From what has preceded it is evident that the passage through which the spermatic cord is transmitted from the abdomen to the scrotum is not a simple ring, as was formerly supposed, but a complete canal, the length of which, in a well formed adult subject, is about two inches and a half. This is not the case, however at all the epochs of life and in both sexes: in fact, at birth, the two apertures of this canal almost directly correspond, or rather there is but one: it is only as we advance towards puberty or the adult age, that the abdominal aperture seems to approximate the os ilium, whilst the external ring always remains in the same relation with the pubis. These changes are satisfactorily accounted for by the rapid increase of the dimensions of the pelvis: every one knows that this part of the trunk is but very slightly developed in the fœtus; but as age advances, the two pillars of the inguinal ring remaining invariably fixed upon the bodies of the os pubis, the opening of the fascia transversalis is obliged to follow the spine of the os ilium as it gradually removes in a lateral direction. We may therefore establish it as a general rule, that the two apertures of the inguinal canal are more nearly approximated in proportion to the youth of the subject:

therefore herniæ are more frequent in children than in adults, notwithstanding the latter are more exposed to the causes which produce them. This difference, in the relation of these apertures in the two ages, also explains the reason why these diseases are very frequently radically cured in early life when they are properly supported; whilst, in more advanced age, it is accomplished with much greater difficulty; for it is evident, that, if the viscera are displaced in the early periods of existence, and a bandage is exactly applied, the double aperture, through which they had protruded, will in a few years have undergone a change in their relations.

The posterior (*abdominal*) opening of the canal corresponds nearly to the middle of the space which separates the pubis from the ilium. In the vertical position, this aperture looks upwards, outwards and backwards; whilst the inguinal orifice is inclined downwards, outwards and forwards. In the horizontal posture the internal ring is turned downwards and outwards, and the external outwards and upwards; consequently, in the first position, the viscera, by their own specific gravity, tend to approximate the two aponeurotic parietes; in the second, on the contrary, these organs naturally fall back into the cavity of the abdomen: therefore, the patient should be in the recumbent posture whenever we attempt the taxis. Then it is also necessary to recollect the obliquity of the canal, which, in conjunction with the cord, presents three different directions, or describes the figure of a Z elongated: whence it follows that the pressure should be exercised at first backwards and upwards, afterwards obliquely outwards. But hernia seldom acquires a large size, or continues long, without producing great changes in this direction: thus, if the displacement does not take place suddenly, the abdominal ring will dilate, enlarge, and especially be thrust towards the pubis: soon after, the external aperture will be forced to yield in its turn, and as it is shut by the bone inferiorly, by the margin of the external pillar inferiorly and externally, and internally and superiorly by the internal pillar, it thence follows, that it cannot dilate or remove but towards its external and superior angle. Then the fibres, or *bandelets* which round off this angle in the natural state, are thrown more or less towards the spine of the ilium, so that the two orifices of the canal almost

directly correspond. We may also form a very correct idea of this mechanism, by supposing, as Scarpa has done, that a power is applied to each extremity of the cord for the purpose of drawing it in a straight line. We must therefore expect to find, in the greater portion of herniæ, that the inguinal canal is actually converted into a simple circle or ring, having at its circumference the same degree of thickness as the abdominal parietes in the vicinity of Poupart's ligament, i. e. about four or five lines. Furthermore, this canal is naturally filled by the spermatic cord, which, on its entrance into the internal ring, is composed only of the vas deferens, the spermatic artery and veins, of nerves derived from the great sympathetic, of a sheath formed by the remnant of the primitive tunica vaginalis, of the cellular tissue which invests the peritoneum, of a third tunic given off from the circumference of the opening in the fascia transversalis, and lastly, of a prolongation of the cellular layer which we find between this fascia and the muscles. After running a few lines, this fasciculus is gradually enveloped with a new sheath, which it derives from the internal oblique muscle; and it is only at its exit from the external ring that the spermatic cord is found to consist of a great number of layers encased within each other. Therefore, in order to arrive at the vas deferens, we will have to divide: 1st, the skin; 2d, the fascia superficialis; 3d, the fibro-cellulous tunic which is detached from the circumference of the ring; 4th, the muscular tunic or cremaster, also situated between two cellular laminæ; 5th, the sheath which appertains at the same time to the fascia transversalis, to the fascia propria, and even to the peritoneum converted into cellular tissue upon the seminal duct.

The relations of all these parts likewise deserve to be known: the artery, veins and spermatic cord constitute the central part, but in such a manner that the artery is almost always external and posterior; the branch of the genito-crural nerve and that given off by the epigastric artery are generally situated internally and posteriorly, and enclosed by the tunica propria of the cord; the ilio-scrotal nerve, on the contrary, runs between the cremaster and the fibrous tunic. We see then that the vessels generally lie upon the groove of the *Fallopian's* ligament, that is to say, behind the cord, which exposes them to the action of the

instrument, when we cut directly upwards, in crural herniæ; and as the spermatic artery, as well as the branch from the epigastric are sometimes of considerable volume, a dangerous hæmorrhage might be the consequence.*

The arrangement which we have given of the parts in the iliac region is subject to variations which it is proper to examine at present, especially in relation to herniæ. We will therefore remark in the first place that the wall of the abdomen is much weaker here than elsewhere; that it also presents some points which are still more feeble than others; for example, it affords less resistance between the ilium and the spermatic cord than between the latter and the pubis; because the fascia transversalis is much thicker in this last direction; but as the first plane is oblique downwards and inwards, a sort of gutter results from it, which conducts, as it were, into the abdominal orifice of the inguinal canal; for which reason external inguinal herniæ are of much more frequent occurrence than internal.

We have already mentioned some of the changes which this species of tumour ordinarily produces, so that it will now be easy to comprehend its mechanism.

(a) *Of External Inguinal Hernia* (Oblique or Indirect Inguinal Hernia). When the viscera, a portion of intestine, for example, drive the peritoneum and its fascia propria before them and enter the internal orifice of the canal, they become enveloped, in their course through it, with the cellular tunic of the cord, the cremaster, and, as they come out of the external ring, by the fibrous sheath which is sent off from the circumference of this aperture, the fascia superficialis and skin; they may remain in the canal for some time before they escape externally, and in this case form a small oblong tumour, which may be readily distinguished in those who are emaciated, but with great difficulty in those of an opposite habit, a circumstance which might be attended with danger; for if this disease occasioned symptoms of strangulation, the surgeon, not seeing a well defined tumour in the scrotum, might attribute them to some lesion of a different nature. Be this as it may, the hernial sac is then elongated in such a manner as to represent the finger of a glove, and not a real

* Arnaud *Mémoires de chirurgie*, tome. 2d page 755.

pouch, as in complete herniæ*. In either of these cases the cord is situated posteriorly and internally; it then begins to be flattened, and if the disease persists and becomes large, it is spread out in the form of membranes, becomes decomposed, if I may so say, so that we may find the spermatic artery externally, the branch furnished by the epigastric internally, and the vas deferens with the veins posteriorly. It is so seldom that the cord is seen upon the anterior part of this species of tumour, that Lassus thinks it is impossible for such a deviation to take place. But Ledran has met with such a case, and Scarpa differs in opinion from Lassus. We may observe, however, that this splitting of the cord is only evident after having passed through the external ring, whilst, near the internal orifice, the parts composing it are generally in juxta-position. When we come to treat of the pubic region we will notice the various degrees of thickening which the different coverings of the hernial sac undergo. Here, the epigastric artery makes a semi-circular turn around the inner side of the neck of the sac; if the hernia is small and recent, and the relations of the two orifices of the canal are but slightly changed, the curve of this vessel will be more or less elongated, and it will pass towards the rectus in such an oblique direction that we may divide the stricture directly upwards, as advised by Rougemont, Scarpa, Astley Cooper, M. Richerand, etc., without danger. It is then only that the oblique division upwards and inwards, recommended by Heister, Platner, Bertrandi, Richter, etc., can be void of peril. If, on the contrary, the hernia is of long standing, the artery, drawn by the neck of the hernia towards the median line, will form a deep loop, and will thereby seem to pass slightly outwards, in order to penetrate the sheath of the rectus muscle; so that if we incise as in the preceding case, hæmorrhage might be the consequence. It would appear then, that, in a strangulated external inguinal hernia, it would be least dangerous to direct the edge of the instrument upwards and outwards, according to the advice given by Lafaye, Pott, Desault, Sabatier, etc., for even should a second epigastric artery exist, as this second branch, in its ascent, deviates more or

* Mery, *Mémoires de l'Académie des sciences*, 1701; Petit tome 2. page 217: Scarpa, page 45.

less from the median line, it would always be avoided, and if the superficial epigastric is wounded, it will not be difficult to secure it. But it is of the greatest importance to distinguish with certainty this species of hernia from the direct inguinal, previous to the operation. We also conceive that the dangers and difficulties will not be the same in all cases, but will vary according to the seat of the stricture. If the external ring, for example, causes the constriction, we may, without great risk, dilate it in all directions; in fact, if we make use of the straight probe-pointed bistoury, that of Pott, those of M. Dubois and Sir A. Cooper; the bistoury of M. Dupuytren with its convex cutting edge, that of J. L. Petit, or the blunt bistoury of B. Bell, conducted upon the extremity of the index finger, there will never be any necessity for introducing these instruments beyond the internal orifice of the inguinal canal. Therefore, since the artery is invariably situated behind the fascia transversalis, it will always be avoided, whether we cut inwards, upwards, or outwards, unless we uselessly pass the extremity of the bistoury as far as the cavity of the belly. If, however, the strangulation is produced by means of the abdominal opening of the inguinal canal, the case is more difficult; for it will then be necessary to conduct the instrument even into the abdomen, either upon the extremity of the finger, when the ring of the external oblique will admit of it, or upon a grooved director, when this opening is too narrow; and as the peritoneum, dragged by the hernia, presses the vessel more or less firmly against the circle of the fascia transversalis, we will, in dilating the latter, almost certainly divide the artery, if it is unfortunately in the situation towards which the bistoury is directed. When the neck of the sac produces the strangulation, we must proceed in the same manner as if the constriction was at the posterior aperture, so that hæmorrhage is equally to be apprehended; however, this last remark is only applicable to those cases in which the strangulation, occasioned by the sac, exists close to the belly; for if, as somewhat frequently happens, this pouch was contracted in the track of the canal, or at its exit from the external ring, it is evident that we would not be obliged to incise as far as the abdominal cavity. After all, it appears to us, from the arrangement of the parts, and the cases related by authors, that the epigastric artery is not so liable to

be wounded as Leblanc, Scarpa, and most modern surgeons are disposed to believe : indeed, without assenting to the opinion of Gunz and Camper, who affirm that this artery deserves no attention in the operation for hernia ; without imitating Louis, Calisen, Bell, and others who do not speak of it, we would do wrong to be alarmed by the vicinity of this vessel. The cases related by Bertrandi, Leblanc and Scarpa, are uncommon, and we may presume that there were peculiarities in some of them with which we have not been made acquainted. As it is generally some lines distant from the internal orifice, as the cellular tissue which envelopes it is supple and very extensible, it glides under the pressure of the herniated viscera, and does not seem susceptible of being divided, excepting by the use of a bistoury with a concave cutting edge, which being raised behind the abdominal parietes, by depressing the handle, when the surgeon attempts to divide the stricture, will thereby include the artery within the circular sweep which it describes. The handle of the instrument, therefore, should always be elevated more or less when in the act of dividing the stricture. Fortunately, the external strangulation is the most frequent ; but as the other species are not very rare, the surgeon should always keep them in mind, when he seeks to unbridle a strangulated hernia. For, if the external ring only is dilated, when the strangulation exists at the posterior orifice, the reduction will be impossible, or at least incomplete ; that is to say, if the hernia is small, the intestine might be pushed between the two apertures of the canal, in which case the symptoms of strangulation will still continue ; or, if the hernia is very large, the two parietes of the canal might be separated to a greater or less extent, without facilitating its reduction ; and then new symptoms will be added to those of strangulation.

At first sight, we would scarcely suppose that the neck of the hernial sac could occasion strangulation, if observation had not demonstrated it a thousand times. In fact, the peritoneum is too thin, too supple, and does not present sufficient resistance, in the natural state, to occasion a formidable constriction ; therefore, this effect never occurs in recent herniæ. But when the disease has existed for a long time, the cellular tissue which invests this membrane, and the tunic furnished by the *fascia transversalis*, become thickened and lose their extensibility ; besides,

the peritoneum, drawn upon by the tumour, becomes plicated in traversing the canal, and its folds, being long pressed together, at length are agglutinated; whence results a circle or a species of ring, the thickness of which will be double, triple, etc., that of the peritoneum in the natural state. From this we conceive that the contraction will generally exist at the posterior opening of the canal; we also consider that the ring of the fascia transversalis must at the same time acquire greater strength and thickness, and that these two causes frequently combine to effect the strangulation, which is perhaps too exclusively attributed, by some surgeons, to the neck of the sac, and by others to the opening in the fascia. We do not pretend to deny that the sac alone cannot produce this accident: we have dissected subjects with herniæ, in whom the pouch under consideration presented so much resistance that it was almost impossible to introduce the finger or any other body into it, without employing a considerable effort; but we merely suppose that the exact proportion of each of the two cases has not yet been ascertained, and that both are very frequently combined. Be this as it may, the contraction may also exist in another point of the hernial sac; we have observed it whilst this pouch was still in the canal, after its exit from it, and even in the scrotal portion. It may also be contracted in several places at the same time, and we have sometimes met with two, three, and even four constrictions, at different distances, as is observed in the sacs called by M. J. Clouquet globular or multilocular. This last form is only seen in ancient herniæ, or those which have been badly supported: thus, a tumour of this kind may be reduced, and the sac remain in the canal; a suitable bandage may then be applied and worn for some months, or rather years, and the hernia will not reappear; but at the end of this time, the patient considering himself cured, or for some other reason, displaces his bandage, and if he makes a considerable effort the tumour will return: but it will now be obliged to envelope itself in a new sac, because the opening of the old one has become contracted or obliterated, so that the viscera can no longer penetrate it, and it is driven before the new bag into the scrotum. Should the reduction be again effected, as in the first instance, and the hernia return anew, this second pouch will be repelled by a third; and so on. A man

may also have had an irreducible hernia for many years, when an additional portion of intestine may be suddenly and forcibly propelled into the inguinal canal; then, as the former sac was previously filled and its neck more or less contracted and thickened, it will descend *in toto*, and will be surmounted by a sac of a new formation, and this may be repeated several times. It is only in those cases where the strangulation is produced by a contracted point of the serous pouch which envelopes the hernia, that the instruments of Thevenin, Arnaud, and Leblanc, might sometimes be substituted for the bistoury. Furthermore, it is easy to comprehend how dangerous it would be to dilate the orifices of the inguinal canal without touching the sac, or opening it only so far as the ring of the external oblique, as recommended by J. L. Petit, Sir A. Cooper, and some others. It is too evident that after a similar operation, in the species of hernia under consideration, the reduction, although easy enough, would remedy nothing, as the cause of danger would still continue. As to the circumstances which would enable us to foresee such a disposition, it is easy to conceive them. Indeed it appears that this cause of strangulation must be much more frequent when the hernia is congenital, as Pott, Wilmer, and Sandifort have observed, than in all the other cases, especially when the disease has been of long standing or badly supported, etc.

The hernial sac may also produce strangulation in another manner; it may be ruptured, and the viscera may insinuate themselves into the opening thus formed. J. L. Petit, and * M. Raymond† have met with examples of this kind, and in the operation they require particular precautions, because the viscera are more approximated to the skin than in ordinary herniæ. But we will resume this subject when we examine the pubic region: when we will also speak of strangulations produced by constrictions of the intestine, by the epiploon, membranous bands, etc.; we will merely observe here that fatty tumours may fill the canal, pass through it, and occasion all the symptoms of strangulation. These tumours may be mistaken for epiploceles, and thereby give rise to serious mistakes. We are of opinion that, as they enlarge, they will drag the peritoneum along with them, which will in

* *Vide* Garengéot tome 1^{er}, page 323.

† *Journal de Médecine* etc. par Corvisart, Leroux, etc., Avril 1808.

this way form a canal into which the viscera may enter, and thereby constitute a perfect hernia. Nevertheless, the cases related by Scarpa, MM. Tartra, Pelletan, Bigot, Olivier, Cruveilhier, prove that the symptoms generally determined by fatty herniæ are owing to inflammation of the peritoneum, and not to constriction of the intestine, which is almost always found free in the abdomen. Can the presence of these fatty tumours then be a cause of peritonitis?

Congenital inguinal hernia is always external (*oblique, indirect*); consequently, the epigastric artery being always on its internal side, we may dilate the stricture upwards and outwards without apprehension. In order that we may comprehend the manner in which this tumour is formed, it is necessary to recollect that the testicle in the fœtus is at first situated in the lumbar region, behind the peritoneum; that it is afterwards drawn gradually outwards by a prolongation of the fascia superficialis, which enters from the exterior into the external ring, traverses the canal, penetrates into the iliac fossa, and terminates by attaching its extremity to the testicle, forming a species of hollow tube; but this *gubernaculum testis* gradually shortens itself, drawing with it the seminal gland, or is repelled by it; on the other hand, the testicle is intimately adherent to the peritoneum throughout its whole circumference, except at its posterior margin, where it receives the vessels, vas deferens, and the ligament of the superficial fascia, under consideration. Then, as it passes through the internal orifice of the inguinal canal, or rather, as it traverses the paries of the abdomen, (for as yet there is no canal,) it brings with it the abdominal serous membrane, and is soon found suspended in the scrotum, by means of the tubulated ligament, in an inverse direction to that in which it adhered to it when in the abdomen; and it is through the opening of this last canal that fluids infiltrate from the abdomen into the scrotum, in order to form congenital hydrocele; that the intestines and other viscera take their course in herniæ of the same species, etc. Notwithstanding this opening naturally closes at birth, and even before, it sometimes happens, however, that it persists to an advanced period of life; therefore, it is not impossible to meet with an inguinal hernia in the adult enclosed in the same sac with the testicle.

In the adult female, the inguinal canal is small and almost entirely filled by the ligamentum teres uteri (*cordon sus-pubien*), which is composed of the same elements and possesses the same relations as in the male. From this peculiarity, it follows that inguinal herniæ, without being very rare in the female sex, are much less frequent than crural herniæ, whilst in man, the reverse is observed. In childhood, however, such is not the fact; for then the tract through which the round ligament of the uterus or spermatic cord runs, being only a simple ring, the viscera escape as readily above the crural ligament in the very young girl as in the little boy.

(*b*) Internal (*direct*) inguinal hernia is much more infrequent than the preceding, which is accounted for by the greater degree of resistance afforded by the parts through which it must pass. We have already seen that it may take place in two ways: 1st, by the *fossette* which separates the umbilical ligament from the epigastric artery; 2d, by the excavation which exists between the bladder and umbilical artery. In general, this last species is not mentioned: to the first, however, the attention of surgeons has been more particularly directed, by the accurate description of it which Hesselbach has given.

In this hernia, which we also call *direct*, the viscera are obliged to drive before them: 1st, the peritoneum; 2d, the *fascia propria*; 3d, the *fascia transversalis*, which is not sufficiently extensible to yield for a long time; consequently, if the tumour acquires a certain volume, it becomes lacerated, or its fibres separate, and the cellular tissue which attaches it to the internal oblique muscle is immediately applied upon the two preceding coverings; 4th, the spermatic cord and the origin of the cremaster muscle; 5th, the internal pillar of the ring, and soon the fibrous sheath which is derived from this aperture; 6th, the *fascia superficialis* and the skin. We find then that the tumour, in traversing the abdominal paries, differs from that which takes the course of the canal, inasmuch as the organs which are displaced escape through a single instead of a double aperture, passing obliquely from behind forwards and from above downwards, and not from without inwards, the spermatic cord being almost uniformly on its outer side, and more or less behind it, whilst in the oblique hernia this organ lies on its inner side. This last character is of the highest importance, when it becomes neces-

sary to divide the stricture, and it may always be ascertained during the operation. Chopart and Desault had already observed, without sufficiently explaining the reason, that, in cases of inguinal hernia, where the spermatic cord was situated upon the external side of the tumour, the division of the stricture should be made upwards and inwards, whilst in all other cases it was necessary to cut outwards and upwards. We may remark, however, that this disposition exists only when the hernia is of small size, for if the rupture is of long standing, this distinction is much less positive. We may also say as much of the globular, or spherical figure, assigned to the internal inguinal hernia by Hesselbach. In works of pathology, we will find how great is the difficulty of distinguishing between these two kinds of tumours; yet without this distinction the surgeon will always be undecided with respect to the side of the sac upon which the epigastric artery lies, and it is especially on account of the relations which exist between this vessel and the neck of the tumour, that the diagnosis of internal inguinal hernia is of such great importance. In fact, the artery is constantly on the outer side of this species of rupture, and, when the tumour has become considerably enlarged, it may even be inclined so much forwards that it will be necessary, in dividing the stricture, to direct the edge of the bistoury very obliquely inwards and upwards. This is not all; the viscera may also protrude below the pubic branch of the epigastric artery, when this branch originates higher than usual, in which case it will form, with the trunk which furnishes it, two thirds of a circle, which will be applied upon the external, internal, and superior sides of the neck of the hernia: so that, in dilating the stricture in this case, it appears almost impossible to avoid hæmorrhage. Finally, although this arteriola generally passes below the neck of the hernia, it is possible that the inferior branch, which was mentioned when treating of the hypogastric region, may cross the superior part of the tumour, which would then be surrounded by a complete arterial circle. There is really something disheartening in a similar arrangement, and the surgeon can scarcely divide the stricture of an internal inguinal hernia without trembling. Nevertheless, we venture to say here, with M. Richerand, that the danger appears much more formidable in books than in nature. It is in fact very sel-

dom that the two accessory arteries just mentioned are so large as to occasion a dangerous hæmorrhage, neither is it common to see them so distributed that there is any danger of wounding them, if we take those precautions which the operation requires in all cases. It is the epigastric artery alone then which may be wounded, and a wound of this vessel is formidable; but it may always be avoided, if the operator is positive that the hernia is of the internal inguinal species, by dividing the stricture in the direction of a line drawn from the external ring to the umbilicus. Now it will not be very difficult, in the greater proportion of cases, by recollecting the characters laid down by Hesselbach and what has just been said, to acquire this knowledge before commencing the operation; to these we may also add the direction obliquely backwards, and rather inwards than outwards from the opening through which the viscera have escaped; and, although this species of hernia may be large and of long standing, the spermatic cord will still be almost entirely on the outer side of it, when it is yet contained in the inguinal canal, and if we make slight tractions upon it, or upon the hernial sac, we will see if these parts follow the same line in their course from the abdominal cavity.

Furthermore, as the organs which form the hernia do not protrude through a very narrow natural opening; as they separate, or lacerate, the fibres of the fascia transversalis, which, occasionally, they push before them; as this hernia is never congenital, the strangulation almost always exists at the ring of the external oblique, seldom at the neck of the sac, and still more unfrequently at the opening of the posterior aponeurosis. Consequently, if we content ourselves with dividing a part of the circumference of the ring of the external oblique, without introducing the point of the knife into the abdomen, it is evident that the constriction will cease, and that on whatever side of the neck of the hernial sac the arteries may be situated, we will run no risk of wounding them.

When the internal inguinal hernia escapes from the abdomen between the external margin of the rectus muscle and the umbilical ligament, the epigastric artery is generally thrown very far outwards, and its pubic branch is always inferior to the neck of the tumour. In this case, the envelopes of the hernia are the

peritoneum, fascia propria, the fascia transversalis when it has not been lacerated, some fibres of the internal oblique muscle, different from those of the cremaster, the fibrous tunic, etc.; the tumour passes very obliquely outwards, presses against and projects the internal pillar of the ring, for a greater or less length of time, before it escapes through this orifice, is more approximated to the pubis than the preceding, and moreover presents all the characters which distinguish it. Generally there is but one inguinal hernia on each side; but sometimes we meet with two, and even three, very near each other, in the fold of the groin. J. L. Petit,* Arnaud,† Masselin,‡ Wilmer,§ A. Cooper, and many others have observed facts of this kind. Petit thinks that, in those patients of whom he speaks, the viscera had not escaped through the ring itself, but had separated the tendinous fibres of its pillars. When we were treating of the aponurosis of the external oblique, we mentioned that such a thing was possible. Nevertheless, whenever it has been possible to investigate the parts after death, the double hernia has been found to pass through the external ring, although its two portions had not entered the same aperture posteriorly. Wilmer pretends that, in the subject examined by him, the two herniæ passed through the inguinal canal side by side, each enveloped in a distinct sac. Searpa presumes, on the contrary, that one of the tumours was external and the other internal. Indeed, this is almost always the manner in which the parts are arranged; that is to say, that one portion of the viscera penetrate into this canal, through the abdominal orifice, on the outer side of the epigastric artery, whilst the other portion gets into it between the same artery and the umbilical ligament. But two external inguinal herniæ may exist simultaneously; a congenital hernia, for example, with an accidental hernia; in the same manner that two and even three internal inguinal herniæ have been met with. Sir A. Cooper, who has observed this last case, says that two of the tumours had escaped between the epigastric and umbilical arteries, and that the third had protruded at the *pubio-vesical fossette*. Several dried specimens of these double herniæ, prepared by M. J.

* Tome 2, page 216. † Mémoires, tome 2, page 603. ‡ Bibliothèque de Richter, tome 7, page 591. § Observations on Hernia, page 104.

Cloquet and some other anatomists, are deposited in the Museum of the Ecole de Medicine.

Recapitulation. The iliac portion of the abdominal parietes is composed of different strata, arranged in the following order of super-position: 1st, the skin, more delicate externally, thicker and covered with hairs internally; 2d, the subcutaneous layer and the fascia superficialis, enclosing between their laminae some nervous filaments, the superficial epigastric artery, and the subcutaneous veins; 3d, the aponeurosis of the external oblique, attached to Poupart's ligament, perforated near the pubis in order to give passage to the spermatic cord, over which a fibro-cellular sheath passes which is given off from the external ring; 4th, a thin cellulous laminae, which sometimes contains adipose cells, especially in the vicinity of the ring; 5th, the internal oblique muscle, the inferior and internal fibres of which being supple and lax, separate and curve over the anterior surface of the cord to form the cremaster; the cord itself, in which we find from above downwards and from without inwards, the ilio-serotal nerve, the cremaster muscle, the cellulous sheath, the genito-crural nerve, the spermatic artery and veins, the vas deferens, the epigastric artery; then, anew, the cellulous tunic and the cremaster muscle which is here very thin; afterwards, the gutter of Poupart's ligament, which gutter determines the thickness of the abdominal paries immediately above it; it is about four or five lines in breadth in the vicinity of the ring, and becomes converted into a simple border towards the spine of the ilium: 6th, the transversalis muscle, in the superior half of the region only; 7th, a second thin cellular layer, which sometimes contains adipose vesicles; 8th, the fascia transversalis, divided, as it were, into two portions by the passage of the spermatic cord, and continuous with the posterior margin of Poupart's ligament and the tendon of the rectus muscle; 9th, a fascia which partially furnishes the cellular sheath of the cord; 10th, the cellular tissue which invests the peritoneum, or the *fascia propria*, sometimes thicker and more dense than the preceding, giving a sheath to the epigastric artery and veins, to the umbilical ligament, and is likewise prolonged upon the cord, in order to concur in the formation of its proper or cellular tunic: 11th, and lastly, the peri-

toncum, which is thinner inferiorly than at its superior part, but also much more supple and extensible.

Such is the collection of the parts which constitute the parietes of the abdomen. We will now examine the interior of this cavity, and afterwards pass in review the viscera which it contains.

ART. IV. OF THE ABDOMINAL CAVITY.

This is the largest cavity of the body. Its figure is oval, the largest extremity of the oval being situated inferiorly in a well formed woman, superiorly in man and especially in children; its transverse section is reniforme, which is owing to the projection of the vertebral column; its vertical axis is the longest, and is generally slightly inclined to the right, which accounts for the greater frequency of herniæ on this side (*Béclard, M. J. Cloquet*). The length of this axis varies according to age, sex and numerous other circumstances. Thus, in childhood, in females in general, in drop-sical persons, during pregnancy, expiration, etc., it is proportionately longer than in the adult man, and during inspiration. The transverse diameter varies in proportion to the variations of the general cavity. The antero-posterior diameter is much shorter upon the median line than at the sides, and generally more extensive inferiorly than superiorly. This cavity terminates below at the pelvis minor or pelvic excavation, which may be considered as a species of appendage to it, which we will examine separately.

We will successively pass in review: 1st, the superior, or diaphragmatic paries; 2d, the anterior paries; 3d, the lateral parietes and 4th, the posterior paries, of the abdominal cavity.

Sect. 1. The Superior Paries.

This is formed entirely by the diaphragm and represents a species of vault which is prolonged upon all the other parietes; its depth is very variable, but these variations act upon the vertical dimensions only of the cavities of the abdomen and thorax. Considered from before backwards, in the direction of the median line, this vault is prolonged very far upon the spine, and ascends a little in the chest: it is, consequently, inclined downwards and for-

wards; upon the sides, it ascends much higher, but it stops at the last rib. It is always more elevated on the right than on the left, on account of the presence of the liver in the former direction. During forcible expirations in infancy, or when the belly is very much distended by pregnancy, ascites, or some other disease, the diaphragm may ascend as high as the sixth rib; in which case, wounds penetrating the chest in this situation, would be more liable to injure the viscera of the abdomen than those of the thorax; and also, as the lungs are repelled towards the upper part of the costal region, the sound of respiration will not be perceived in the inferior half of the cavity which contains them. Hydrothorax, empyema, and every other thoracic extravasation, on the contrary, will depress the superior paries of the abdomen. The lateral excavations of the diaphragm form, properly speaking, the hypochondria, whilst the posterior part of this muscle corresponds to the epigastric and umbilical regions. The peritoneum lines it completely in the left hypochondrium, but does not adhere to it very intimately. On the right side it supports the liver by means of lateral serous duplicatures, named triangular ligaments, and by the circular union called coronary ligament; but in such a manner that the diaphragm and liver are in immediate contact to the extent of four or five inches transversely, and of one or two inches from before backwards, that is to say that, in this space, they are united merely by cellular tissue, which is so abundant that inflammation must be more frequently developed in it than elsewhere. Now, as the base of the right lung rests upon this point, it follows that inflammatory adhesions may very readily take place between it, the diaphragm and the liver, so that abscesses primitively formed in the latter organ, may be evacuated through the bronchi. In these diseases, it is evident that if the union of the lungs is not sufficiently intimate, the pus will be extravasated into the thorax.

The peritoneum adheres most firmly to the central tendon, so that it is very difficult to separate them; whilst, upon all the other parts of the diaphragm, it is only connected to the fleshy fibres by means of a pretty extensible cellular layer, which freely communicates with the cellular tissue of the chest through those numerous apertures which give passage to the vessels, nerves, œsophagus and also through the separation of the muscular fasciculi

which are inserted near the xiphoid cartilage. Furthermore, this layer is only a portion of the general cellulous sheet which invests the peritoneum and the pleuræ. The elements which enter into the composition of the diaphragm can be the subject of but few surgical remarks. We have just noticed the serous membrane and the cellular tissue.

(*a*) The muscular fibres may be considered as originating from the internal surface of the base of the thorax, where they intersect those of the transversalis; so that the simultaneous contractions of these two muscles increase the perpendicular diameter of the chest, without diminishing its transverse dimensions. As all these fibres converge towards the central tendon, and as the lesser muscles of the diaphragm are inserted into the posterior notch of this tendon, it follows that the spine becomes the fixed point, and that the depression produced by the contractions of the diaphragm, carries at the same time the viscera forwards. It also follows that the lateral portions are much more moveable than the central part, and that the liver on the right and the stomach on the left, rise and fall very perceptibly during the respiratory movements, whilst the heart, which rests upon the epigastric or middle portion, scarcely changes its position. Between the crura of the diaphragm there are two important apertures: the one on the left, opposite to the first lumbar vertebra, gives passage to the aorta and thoracic duct; this opening is a fibrous ring, completed posteriorly by the bodies of the vertebræ, and is so constituted that the vessel can never be compressed during the contractions of the diaphragm; the other is more anterior, nearer the median line and upon the fore part of the eleventh dorsal vertebra. It is entirely muscular, and therefore susceptible of contraction; but it embraces the pneumo-gastric nerves and œsophagus, the functions of which may be momentarily suspended, without immediately compromising the life of the individual. The fibrous centre also presents an opening, which is situated about three fingers' breadth to the right of and anterior to the œsophageal aperture. It is formed of fibres which intersect each other in four different directions, and are blended, as it were, with the circumference of the vena cava which passes through it; so that this vein cannot be compressed during the contractions of the diaphragm.

(*b*) The *arteries, veins, and lymphatics.* The two phrenic arteries, having separated from the aorta, take their course between the peritoneum and the inferior surface of the diaphragm; they are so distributed that their anterior branches anastomose with the internal mammary and the epigastric; that the lateral branch inosculates with the intercostals and lumbar arteries; so that they would form an important means of communication in case of the obliteration of the aorta. They are sometimes so large, that if wounded by an instrument penetrating one of the hypochondria, they would occasion a profuse hæmorrhage. The supra-diaphragmatic arteries derived from the subclavian, or internal mammary, are too small to require particular attention.

(*c*) The *Nerves* which preside over the functions of the diaphragm appertain to three orders: 1st, we find the nerve proper, phrenic, or internal respiratory, derived from the cervical plexus, and which accounts for the acute pains which persons who are affected with disease of the liver feel in the corresponding shoulder and side of the neck. As this nerve sends some filaments into the cellular space previously noticed, we may presume that the phenomena under consideration, are particularly developed when the pathologic lesion is seated in the convex surface of the liver. We also meet with some twigs from the eighth pair, which probably preside over the sensibility of the diaphragm, as well as that of the lungs, relative to respiration; whereas the preceding seems to have influence over the muscular contractions; finally the plexiforme fasciculi of the great sympathetic, the functions of which are no better understood here than elsewhere.

Some anatomists pretend that the diaphragm is primitively formed of two muscles; but this opinion does not seem to us to have been demonstrated in man; for, if it is true that cases of this kind have been met with in the very young fœtus, it is also certain that, in some of a month old, in our possession, it does not exist. Neither is the escape of the abdominal viscera into the chest, which has been repeatedly observed in new born infants, an incontestible proof of it; for we do not see that, in the facts related by Peyer, Platner, and those collected by Morgagni, the anormal fissure was situated more upon the median line than upon the side. We ourselves have seen two examples of congenital perforation of the diaphragm: in one, the stomach, a portion of

the transverse colon, and of the small intestines, were in the same cavity with the left lung: the diaphragmatic opening was smooth, circular, and admitted the introduction of the extremities of five fingers in the form of a cone, and was situated in the bottom of the left excavation; in the other, which was dissected by Dr. Meyranx, the opening existed at the same point; it was a little larger, and the spleen had passed through it. It is probable then that these openings are not the remains of natural divisions, but complete lacerations, the edges of which have become cicatrized.

And furthermore, there are also examples, in the adult, where the organs have passed from the belly into the chest, through the diaphragm, forming a diaphragmatic hernia. Sometimes this species of hernia takes place suddenly through a rent in the muscular fibres and the two serous membranes which invest them, in consequence of a violent effort; at other times, it is formed in an insensible manner, in which case the fibres are simply separated, and the pleura and peritoneum being compressed together by the parts which are displaced, thereby form a double hernial sac. The case related by J. L. Petit* should be ranked with this species, as well as that published by M. Ollivier of Angers.†

Sect. 2. Anterior Paries.

It forms the internal face of the epigastric, umbilical, hypogastric and iliac regions. Its transverse extent is, consequently, much more considerable inferiorly than superiorly. Nearly in the centre of the median line it presents the umbilicus, at which four ligamentous cords terminate, or three vessels and the urachus, according as we examine it in the fœtus or after birth, one of these cords passes obliquely upwards and backwards to the right, as far as the longitudinal fissure of the liver, and is attached to the epigastric region by a triangular fold of peritoneum (*falciforme ligament*) which terminates in a point at the navel. Behind the linea alba the anterior margin of this fold splits into two laminæ, leaving a space between them which is generally filled, with adipo-cellular tissue. It sometimes happens that a cluster of

* *Mémoires de l'Académie des Sciences.*

† Supplément au Traité des Hernies, de Scarpa, p. 183.

these adipose vesicles become enlarged ; in which case, if the linea alba is separated, or if any apertures exist in it, a fatty hernia will form, and the liver will suffer sympathetically, on account of the tractions exercised upon its suspensory ligament by the tumour. A case of this kind is related by M. Ollivier in the *Supplement au Traité des Hernies, de Scarpa*, page 114. This ligament, which was formerly the umbilical vein in the fœtus enveloped in a duplicature of the peritoneum, is usually closed in the adult ; but it may remain pervious ; for which reason when we wish to divide the stricture, in the operation for strangulated exomphalos, or when we are obliged to dilate penetrating wounds in this region, the incision should be inclined to the left side.

The second cord, or urachus, which descends perpendicularly upon the summit of the bladder, following the posterior surface of the linea alba, is a complete canal in the first months of fœtal existence, and forms a communication between the bladder and the allantois (*vesicula umbilicalis*). It is generally obliterated at an early period, but sometimes continues pervious at birth, and even in the adult, so as to permit the urine to dribble out at the navel : a very remarkable case of this kind is cited by Cabrol.* In such cases the internal membrane of the bladder becomes turgid and prominent, forming a species of fungus at the fore part of the umbilicus. This tumour, which existed in the case of the surgeon of Montpellier and was described as a hernia, does not seem to us to merit this title in the least. It is a state similar to that which the intestine in an artificial anus presents. Howsoever this may be, it is never covered by the peritoneum ; and as it conceals the umbilicus, it is probable that facts of this nature have more than once given rise to the supposition of the non-existence of the umbilical cord in the new born infant. For example, it is evident that in the case related by Van der Wiel, in which an excrescence was situated above the pubis of the child, the mistake was owing to this mal-formation. Sometimes, when the bladder is prolonged so high as the umbilicus, the linea alba gives way, and then a hernia of this organ is formed which is destitute of a sac : but in other cases, the anterior paries of the urinary reservoir is wanting, and its internal and posterior sur-

* Observations rares, etc. Obs. 20.

face becomes everted through the deficiency of the abdominal parietes, forming a fungus protuberance upon the fore part of the hypogastrium, in which the termination of the ureters is visible. This state constitutes the extroversion of the bladder, which may exist in a great number of degrees, and generally coincides with other anomalies of organic developement which prevent infants thus constituted from living beyond a few months: nevertheless, there is a young man in the general hospital of Tours, who has supported this infirmity twenty or twenty-five years, enjoying at the same time a tolerable share of good health. In this individual there is, above the symphysis pubis, a red and fungus substance, about the size of a dollar, at the bottom of which two orifices are perceived through which the urine continually exudes, which renders it necessary for him to wear a robe.

Finally the last two cords proceed from the umbilicus, diverge as they descend, and terminate in the hypogastric arteries; these are the umbilical arteries, reduced to a ligamentous state in the adult. Between them, the urachus and bladder we observe two triangles, broad and excavated inferiorly, where they form the internal or *pubio-vesical fossette* of the iliac region; through which *fossette* the viscera sometimes, but rarely, protrude. These cords are narrow and superficial near the umbilical ring, so that where they terminate, or come in contact, the umbilicus is weakest; from which circumstance accidental herniæ very frequently escape at this point.

From what has preceded, we see that these four cords make a relief within the abdomen, which becomes more prominent in proportion as they recede from the umbilicus. Near this cicatrix they are but simply applied between the muscles and peritoneum; but in proportion to their descent they are gradually surrounded by this last membrane, until they are completely enveloped in it; therefore, in the very young infant, the umbilical vessels and urachus will be more promptly wounded, the nearer the injury received approximates to the umbilical knot.

Whenever the viscera protrude through the umbilical ring previous to birth, they compress the vein and arteries and may thereby obstruct the fœtal circulation. We have already stated that, in the adult, the hernia escaped by the side of the navel, which is then the strongest point in the abdominal parietes, whilst its pe-

riphery, as Colles has observed, is actually the weakest ; and the reason that umbilical hernia do not occur here more frequently than in the groin, is, because expulsatory efforts act less forcibly upon the former part than the latter. These herniæ, in the adult, are generally formed by the epiploon ; in childhood, on the contrary, as this membrane is but slightly developed, we usually find a portion of the transverse colon, sometimes the stomach, liver, etc., in the tumour. We do not mean to say that these organs are never met with in the umbilical herniæ of adults, but that they almost always drive the gastro-colic omentum before them, and we may conclude that, when operating for this species of rupture, if the intestine does not present itself covered by this membrane, and a portion of it exists behind, it has passed through a perforation in the latter* ; indeed, according to Arnaud, this aperture may contract to such a degree around the neck of the intestine as to produce strangulation. We may also remark here that the weight of the viscera and their natural functions constituting so many continual causes of traction, the tumour must be more frequently accompanied with cholics than in other regions of the abdomen, and that these tractions sometimes give rise to serious symptoms, independent of strangulation. Strangulation is also a more rare occurrence in exomphalos, because the opening forms only a simple ring, and not a canal, as in the iliac region ; a peculiarity which also renders the reduction more easy, and requires us, in order to effect it, to push the organs directly backwards. In accidental umbilical herniæ, however, as the natural cicatrix produces a very firm agglutination of all the tissues, the viscera are obliged to detach the skin in the direction opposite to that which it occupies. But it is merely necessary to note this disposition, in order to show the direction in which the taxis should be applied.

With respect to the formation of the sac, Scarpa maintains, in opposition to the opinion of Dionis, Garengéot, and J. L. Petit, that the exomphalos is never destitute of it, but only that this pouch is sometimes so adherent to the layers which cover it, that it may be readily overlooked in a superficial dissection. Without attempting to controvert the assertion of the celebrated sur-

* Observations pathologiques de Sandfort.

geon of Pavia, it appears to us that the compact structure and unyielding nature of the peritoneum, in the vicinity of the navel, would render the opinion of Dionis at least probable in some cases. In hydromphalos, the separation of the aponeurotic fibres almost always occurs in the same points at which herniæ protrude, that is to say, at the apex of the spaces circumscribed by the umbilical arteries and urachus; and for this reason, because the linea alba is weaker in the inferior semi-circumference of the umbilical ring, than in the superior. The serous membrane then, being propelled by the fluid, traverses the aponeurosis, and the parietes of the tumour are consequently formed by the skin, the subcutaneous layer, and the peritoneum.

In the superior and middle part of this paries, we observe the posterior surface of the xiphoid cartilage, the point of which may be so much incurvated as to press upon the stomach, and occasion distressing symptoms; symptoms which may be removed by cutting through the abdominal wall and elevating this point, as has been practised by M. Billard of Brest. Upon the sides of this appendix, the aponeurosis is weak, and the space which separates it from the costal cartilages is a little broader on the left than on the right; so that this, in addition to the presence of the liver in the latter direction, will enable us to account for the more frequent occurrence of herniæ of the linea alba upon the left side of the xiphoid cartilage of the sternum. At the inferior and middle part, the urachus dilates in order to become continuous with the bladder which ascends more or less towards the umbilicus, when filled with urine, so that it might form a hernia; externally, if any fissure should exist in the aponeurosis. Upon the sides of the summit of the bladder, we enter into the internal surface of the iliac region, where we meet with the three inguinal fossettes pointed out when speaking of the epigastric and umbilical vessels. One of these fossettes is very superficial, is inclined downwards and outwards, and is limited by the spine of the ilium and the epigastric artery; it leads into the inguinal canal, and may be called the *external inguinal fossette*. The second, much deeper, but narrower, looks directly forwards and downwards; it corresponds to the ring of the external oblique, and is limited externally by the preceding, and internally by the umbilical artery: this is the *crural fossette*. Finally, the third is triangular, is still

more excavated, looks obliquely outwards, and corresponds to the posterior surface of the rectus muscle; we will name it the *internal iliac* or *pubio-vesical fossette*; it is this which forms the basis of the omphalo-vesical triangles, which we have just treated of.

The rest of the anterior paries is smooth, regular, and does not present any thing remarkable.

Sect. 3. Lateral Paries.

This is formed by the internal region of the flanks, and is continuous, superiorly, with the hypochondria; inferiorly, with the iliac fossa. The peritoneum appertaining to it is thick, strong, and adherent, but anteriorly only; for posteriorly, it is very extensible and supple. At its junction with the posterior paries, it presents, superiorly, under the last rib, an excavation of slight depth, which is applied upon the thinnest part of the aponeurosis of the transversalis muscle: inferiorly, near the iliac crest, we find another similar fossette which likewise rests upon an attenuated portion of the fascia lumborum. These depressions are generally concealed by the kidneys or lumbar portions of the colon.

Sect. 4. Posterior Paries.

Upon the median line we find the lumbar vertebræ, which divide this wall into two equal parts, and form a greater prominence in the female than in the male. After long abstinence, in marasmus, or emaciated individuals generally, the anterior paries of the abdomen approximates so much to this prominence, that these parts almost touch each other, so that we can, by pressing upon the umbilical region, readily feel the vertebral column, which might thereby be mistaken for some morbid abdominal tumour. The organs which separate the lumbar vertebræ from the peritoneum are numerous and important. We find,

1st, The *pillars (crura) of the diaphragm*, which descend as far as the fourth lumbar vertebra on the right, and to the third only on the left. They are continuous inferiorly with the pre-

vertebral ligament (*ligamentum commune arterius*), and are directly attached to the vertebræ as high as the first lumbar; from which circumstance the posterior portion of the diaphragm is not so much depressed as we would suppose at first sight.

2d, The *Aorta*, which takes nearly a direct course upon the left side of the spine, gradually approximating the median line until it gets opposite to the fore part of the fibro-cartilage which unites the fourth lumbar vertebra to the fifth, where this artery divides into the common iliacs. In this tract the aorta gives off, from its anterior part; the celiac trunk, the superior and inferior mesenteric arteries; from its sides the renal, capsulares and spermatic arteries, and from its posterior part the lumbar and sacra media arteries. The aorta, for a long time concealed by the crura of the diaphragm, at length becomes exposed, within the abdomen, opposite to the second lumbar vertebra; then its relations are the following: anteriorly, and above the celiac trunk, it is covered by the semilunar ganglion of the great sympathetic nerve; between this trunk and the mesenteric artery, by the solar plexus; more inferiorly, by the aortic plexus or the branches which go to form the inferior mesenteric plexus, and by a few lymphatic glands. On the left side it is in relation with the great sympathetic which approximates it, especially near the sacro-vertebral angle. On the right side and superiorly, it is separated from the vena cava by the corresponding crus of the diaphragm; afterwards these two vessels are in contact, or are only separated from each other by a fibro-cellular membrane. The thoracic duct is at first situated behind it, opposite to the third lumbar vertebra; as it ascends, it inclines a little to the right, and penetrates the chest through the opening which transmits the artery; which is also in relation, anteriorly, with the œsophagus, laterally with the *psœ* muscles. Finally, posteriorly, it is separated from the vertebræ by a small quantity of lamellated cellular tissue, and by the *ligamentum commune arterius*. The aorta is afterwards covered throughout its whole extent, anteriorly and laterally by the peritoneum; in the epigastric region, by the cardia, the splenic vein, omentum minus, the right portion of the stomach and the left lobe of the liver; whence it follows that a cancer of the superior or inferior por-

tions of the stomach, a scirrhus tumour of the lesser lobe, may compress this large vessel and occasion great derangement in the circulation ; that, on the other hand, aneurismal tumours of the aorta in the epigastric region produce, in their turn, inclination to vomit and even vomiting, and may thereby suspend the digestive functions. Between the cœliac and superior mesenteric arteries the aorta is crossed by the pancreas, below the latter artery (superior mesenteric), by the inferior portion of the duodenum ; then we find between it and the anterior paries of the abdomen the transverse meso-colon, the mesentery, the arch of the colon, a great part of the small intestines, and the great epiploon. It is especially in this region that we may easily feel its pulsations in thin subjects, because the intestines are thrown laterally, the colon is drawn upwards by the stomach, the abdominal parietes are very flexible, and the spine is very convex ; so that, under certain circumstances, the aorta may be separated from the umbilical paries by the peritoneum and omentum only, and that, if this large trunk was wounded, it would be possible to suspend its hæmorrhage for an instant, by pressing it firmly against the left side of the spine through the abdominal wall, having previously relaxed the muscles by the anterior flexion of the trunk. We well know that by such means we can only prolong life for a few instants merely ; but there are circumstances where the last words of a dying man are of so much importance, that the greatest value may be attached to the least prolongation of his existence.

In the hypogastric region, this artery is concealed only by the mass of the small intestines and the great omentum.

Furthermore, numerous absorbent glands surround the aorta from the cœliac trunk to the sacro-vertebral angle, which, when enlarged from scrofula, cancer, or other diseases, may compress it very firmly. A scirrhus pancreas may also produce the same effect. When an aneurism of this artery exists, it is somewhat remarkable to see it frequently directing its course backwards, producing absorption of the bodies of the vertebræ, rather than projecting anteriorly and laterally, where none but soft parts exist. In this way an aneurism may produce paraplegia, give rise to the suspicion of vertebral caries, or be mistaken for a *dépôt*

par congestion if it should become prominent in the lumbar region, a curious example of which is related by Doct. Harison.*

From what has just been said we will perceive that the point, at which we may most readily expose the aorta, by cutting through the abdominal parietes, would be that which corresponds to the third lumbar vertebra. For this purpose, it will be necessary to make an incision, several inches in length, parallel to the linea alba, upon the left of the umbilicus, to push the small intestines to the right and then divide the peritoneum upon the left side of the spine, above the inferior mesenteric artery; after this we will have to separate a pretty strong fibro-cellular sheath, which may be torn, however, with the aneurismal needle. At this step we should take the greatest care to avoid the vena cava, which is enveloped in the same cellular sheath. It is on this account that it becomes necessary to pass the aneurismal needle from right to left, or from the median line towards the side. Upon the dead body this operation is not difficult; but in the living, if we may judge from what occurs in animals, the convulsive efforts of the muscles of the abdomen will drive the viscera forcibly through the wound, and thereby render the application of the ligature very difficult. Sir A. Cooper has performed this operation, and although its success was not complete, we cannot but praise his boldness. This operation in fact, has not been lost to the science; for it has demonstrated that the circulation did not entirely cease in the pelvic extremities after the obliteration of this great artery, and it permits us to hope that it may be the means of saving the life of some individuals. There are also a great number of facts in support of this opinion. Thus, the experiments made upon dogs shew that the ligature of the aorta in them is not mortal. We have also dissected a cat in which M. Pinel-Grandchamps tied this artery five months previous, yet the animal continued well until the moment it was killed. The aorta between the two mesenteric arteries was converted into a small solid ligament.

Paris and M. Piorry have found the abdominal aorta so much contracted, that it would not admit of the introduction of a crow quill, yet the subjects died from other diseases. Dr.

*Op. Citat. vol. 2, page 27.

Th. Goodisson found it completely obliterated in the body of a woman forty years of age, brought into the amphitheatre of *la Pitié* in 1818;* and we have likewise related a case in which it was entirely filled with a concrete and solid matter above the common iliacs, in a woman whom we daily attended for a cancerous disease, of which she died.† May we not conclude then from these and many other cases, that the obliteration of the aorta is not necessarily followed by gangrene of the inferior extremities, and that therefore its ligature should be attempted under circumstances which admit of no other resource? Furthermore, by applying the ligature above the inferior mesenteric artery, we preserve a very important anastomosis, since it communicates directly with the superior mesenteric. There are also a great many more for conveying the blood to the inferior extremities. Thus the communications of the lumbar arteries with each other, with the ilco-lumbalis, circumflex iliac, glutæal, intercostals, and with the lateral branches of the epigastric and phrenic arteries; those of the epigastric with the internal mammary, inferior intercostals, phrenic, etc., form so many channels for conducting the blood into those parts which are below the ligature.

3d. The *Vena Cava*, which is situated to the right of and anterior to the aorta at its transit through the diaphragm, becomes more posterior when it gets below the liver. These two vessels are at first separated by the lobulus *Spigelii*, but afterwards approximate, as we have said, and soon come in contact. Anteriorly and superiorly this vein is in relation with the liver, lying in its posterior notch, where it receives the hepatic and other veins before it passes through the diaphragm: from this situation, abscesses of the liver might open into it, if it was not in the nature of the coats of vessels to become thickened, in consequence of surrounding inflammation. Besides, if a purulent collection should make its way into the inferior cava, cases of which *Jamex* affirms he has met with, it is evident that death would ensue immediately. This vein is afterwards covered by the vena porta, the hepatic excretory ducts, the right extremity of the pancreas, the perpendicular portion of the duodenum, the renal artery,

* Anderson, *System of Surgical Anatomy*, etc., page 156.

† Mémoire sur un cas remarquable de maladie cancéreuse, etc., chez Béchot 1825.

small omentum, pylorus, mesocolon, right spermatic artery, the small intestines and the great omentum. Posteriorly, it is at first separated from the vertebral column by the entire thickness of the right crus of the diaphragm, afterwards it rests upon the right portion of the semi-lunar ganglion, then upon the spine. On the right, it is in contact with the liver, capsula renalis, kidney and peritoneum. The aorta runs along its left side. From these relations it follows that induration of the liver or pancreas, cancerous disorganization of the pylorus and mesenteric glands, as well as aneurisms of the aorta, may prevent the blood from ascending by the vena cava to the heart, and thus produce dropsy, as *Monro* has asserted, and *M. Bouillaud* has recently ascertained.

4th. Between the two vessels which have just been examined, the *thoracic duct*, a chain of lymphatic glands and especially some cellular tissue are situated. The latter element presents the same arrangement here as in the posterior mediastinal space, with which it is continuous by means of the aortic and œsophageal apertures, and the interval which exists between the fibres of the diaphragm. It is through the medium of this tissue that fluids which have formed within the thorax, upon the anterior part of the spine, penetrate into the abdomen, and even into the pelvis. Its lamellæ, being very extensible and very supple, permit the lymphatic glands to enlarge rapidly, and to communicate their alterations to those in their vicinity; and, as all these glands are connected by means of vessels which form an uninterrupted chain even to the summit of the thorax, we may easily explain how those numerous tumours (*encéphaloïdes*) have been produced which we meet with upon the fore part of the vertebral column, between the laminæ of the peritoneum, from the sacrum to the neck, in consequence of cancer of the testicle.

5th. The *great sympathetic nerves* are remarkable here on account of their being situated more anteriorly, the irregularity of their figure, and the great plexiforme anastomoses which they form upon the fore part of the pillars of the diaphragm and aorta. It is here, in fact, that the great splanchnic nerves emerge from between the fleshy fibres and collect together, in order to produce the semilunar ganglion; that the lesser splanchnics are spread out before the emulgent arteries, and freely anastomose with the former, with each other, and with some filaments from the par va-

gum, in order to form the solar plexus, and all the twigs which proceed from it. This is that great nervous centre to which the ancient physicians, since the time of Vanhelmont, attributed great importance, and which alone is capable of accounting for those distressing sensations (*douleurs suffocantes*) which certain patients experience in this region, and the dangers which follow blows received upon the epigastrium. On each side, the posterior wall of the abdominal cavity equally presents the peritoneum, some muscles, vessels, nerves, lymphatic glands and cellular tissue, as well as the kidney and its appendages, behind the peritoneum.

1st. The *muscles* are the *psoæ*. The *psoas parvus* is sometimes wanting, and the *magnus* may be considered as consisting of two portions, one of which lies upon the sides of the bodies of the vertebræ, the other upon the fore part of the plates of their transverse processes; between these portions the nerves of the lumbar plexus are transmitted. The *psoas magnus* is separated from the *quadratus lumborum* by the anterior sheet of the aponeurosis of the *transversalis*, and is covered by a fibro-cellular lamina given off from the *fascia iliaca*, which lamina is prolonged as far as the fore part of the transverse process of the last dorsal vertebra, where it assumes the ligamentous structure, forming two fibrous arches, the first of which binds down the origin of the *psoas*, and gives insertion to some fibres of the diaphragm; the second, which extends from the transverse process of the same vertebra to the inferior margin and apex of the last rib, in order to constitute the *ligamentum arcuatum*, the superior border of which receives the lateral portion of the diaphragm, and inferiorly, the aponeurosis expands over the anterior surface of the *quadratus lumborum* muscle. Between this ligament and the ribs, there exists a small space filled with cellular tissue, by means of which the sub-pleural lamellated layers communicate with the subcutaneous cellular mass of the flank. The other arch permits the same tissues which cover the spine within the chest and abdomen, to communicate with each other also. Inferiorly, the *psoæ* muscles separate from the fifth lumbar vertebra, and pass onwards to form the internal boundary of the iliac fossa. As they act principally upon the thighs, long races or forced marches will give rise to pain in the lumbar region, and *psoitis* is

sometimes the consequence of such exertions. On the right, the psoas is covered by the vena cava; the aorta scarcely advances upon it on the left; the great sympathetic nerve runs along the internal margin of these muscles on both sides. When the psoas parvus exists, it is situated on the fore part of the magnus; it is remarkable only on account of its tendon, which will be examined in the iliac fossa.

2d. The *lumbar arteries* arise from the posterior part of the aorta, cross the groove upon the body of each vertebra, and plunge into a species of shut canal formed partly by the bone and partly by the psoæ muscles, or by small fibrous arches,* which attach them firmly to the vertebræ, so that these arteries would be easily lacerated, if we raised the aorta more than a few lines for the purpose of tying it. They are crossed by the great sympathetic nerve, the genito-crural and the lumbar plexus; and when they emerge from beneath the psoas magnus they have already given off their posterior branches: afterwards they run between the peritoneum and quadratus lumborum muscle.

The *lumbar veins* are larger than the arteries, which they accompany. Those of the left side pass under the aorta in order to terminate in the vena cava, in the same manner as the right lumbar arteries cross the posterior surface of this vein. It is extremely rare that these relations vary; nevertheless the vena cava, from the primitive iliacs to the emulgent veins, has been found on the left of the aorta: in this situation it was greatly dilated; afterwards it passed before the artery and entered, as usual, into the notch of the liver†. As the lumbar vessels form arcs of circles which are immediately applied upon the bodies of the vertebræ, they are secure from all compression, either by the muscles or surrounding organs.

3d. The *Lymphatic glands* enter almost entirely into the chain which exists upon the median line; the same chirurgical remarks are also equally applicable to them.

4th. The *nerves of the Lumbar Plexus*. This plexus is formed by the anastomoses of the anterior branches of the lumbar nerves with each other and with the last intercostal upon the fore part of the transverse processes of the vertebræ: all these branches thus mingled are concealed by the psoas; hence when this mus-

* Tiedmann, *Tabulæ Arteriarum*, etc.

† Harriſson, Vol. ii, page 23.

cle is inflamed the lumbar plexus may be severely affected. The genito-crural nerve traverses the fleshy fibres from before backwards, and may be compressed against the vertebræ by tumours developed within the abdomen. The ilio-scrotal and inguino-cutaneous branches pass almost transversely outwards, between the quadratus lumborum and psoas muscles, and soon enter the lateral region of the abdomen; the other nerves are the obturator and crural, which we will see in the iliac fossa.

5th. The *Kidney*. This organ is situated upon the anterior part of the last two ribs and quadratus lumborum, external to the psoas muscle, and is covered by the colon and peritoneum. It is consequently very deeply seated, so that instruments plunged into the anterior part of the abdomen will not reach its anterior surface until it has passed through the liver, spleen or colon, and twice the peritoneum. Posteriorly, however, it may be wounded, without piercing the peritoneum, by passing an instrument through one of the last two intercostal spaces, three inches external to the median line, in which case the diaphragm would also be wounded; or by introducing it through the region of the flanks. The right kidney is situated lower down and nearer the spine than the left; and on both sides the kidneys are prolonged at least two or three inches below the twelfth rib, extending more than one inch beyond the margin of the quadratus lumborum muscle, so as to rest more or less immediately upon the aponeurosis of the transverse, according to the state of *embonpoint* of the subject. Consequently, the convex portion of this gland is its most superficial part and most exposed to injuries; but its vessels are also the smallest; so that wounds inflicted in other parts of this organ would be much more dangerous, on account of hæmorrhage.

The structure of this organ is remarkable for the size of its arteries and veins; phlegmonous inflammations, however, rarely occur in it; doubtless because it contains but little cellular tissue. Being of a dense and compact texture, and enveloped by a fibrous membrane, it seldom enlarges beyond a certain point. Nevertheless it is not very unusual to see it acquire very great dimensions in some local diseases as yet but little understood: but then it is almost always at the expense of the thickness of its parietes that its volume augments; the calices generally be-

come confounded with the pelvis, and the whole kidney soon forms nothing more than a cyst which becomes more and more attenuated in proportion to its dilatation. This disorganization is sometimes observed in persons afflicted with diabetes, and is not unfrequently discovered in subjects in whom its previous existence had not been suspected. In these cases the kidney may become inflamed, and its whole internal structure transformed into a purulent collection,* which may make its way into the excavation of the flank. We have more than once seen abscesses of this organ point in this situation and renal calculi escape through the opening: hence originated the idea of nephrotomy, either for the purpose of extracting calculi, or for giving vent to purulent or serous collections. But, notwithstanding this operation is less difficult than has been supposed, it is nevertheless almost inapplicable; for, on the one hand, the diagnostic marks of these diseases are seldom positive; and on the other, even should we succeed in penetrating to the diseased organ, we only remove one effect of the malady, the cause still continues.

The excavated portion of the kidney is situated anteriorly and internally; it receives the emulgent artery and vein and gives origin to the ureter. These three canals are so arranged, that the artery is in the middle and a little more elevated than the two others; the ureter is situated behind it and a little lower down. The emulgent vein of the right side is much shorter than that of the left, on account of the proximity of the vena cava in which it terminates; with respect to the artery the reverse is observed. There are sometimes two, three, and even four renal arteries, although there is then only one kidney on each side. Such a disposition would be advantageous, in case it became necessary to tie the aorta, if, by chance, the ligature should be placed between the origin of these branches.

The Glandulæ Supra-renales cap the superior extremity of

* Strictly speaking, the structure of an organ cannot be said to be transformed into a purulent collection. The structure is removed by absorption; a cavity is thereby formed, which becomes filled with a secretion poured out by the vessels which terminate upon the internal surface of this cavity; or rather absorption of the original structure and deposition of matter go on simultaneously until the walls of the abscess are destroyed in one or more points, and then collapse.—*Transl.*

the kidney, and touch the solar plexus or even the semi-lunar ganglion. They are of no surgical importance.

The ureter, conducting the urine from the kidney to the bladder, descends parallel to the vertebral column, upon the fore part of the psoas muscle, enveloped in a sheath furnished by the fascia propria or sub-peritoneal cellular tissue. Its tunics are very firm, but not very thick: its calibre has sometimes been found to equal that of the small intestine, in cases where the urine has been prevented from passing on freely to the bladder by a calculus lodged within its canal. It may also be ruptured, and occasion a mortal extravasation within the peritoneum.

6th. The *Cellular tissue*. It is very abundant, and presents two different forms of arrangement. In the first place, its lamellæ are approximated, forming a species of membrane, which is only a portion of the fascia propria, and which is intimately united with and spread over the external surface of the peritoneum; next, it envelopes the kidney, the psoæ muscles, and fills all the spaces which separate the different organs which have just been pointed out; it especially forms a very thick cushion around the kidney, and it is generally this cellular tissue which inflames in the deep-seated phlegmasiæ of the lumbar gutters of the abdomen; it also inflames in consequence of peritonitis; finally, its lamellated structure, its quantity especially, the nature of the organs which it envelopes and its contiguity to them, are very favourable to the formation of abscesses beneath the peritoneum, in the point under consideration. It is also the seat of disease in the inflammation called *psaitis*. As it is continuous with the cellular tissue of the anterior part of the spine, and consequently with the general layer of the abdomen and thorax, it follows that fluids may make their way into it from a great number of points. On the other hand, when abscesses are formed in it, the pus may penetrate into the iliac fossa, or pass under the integuments of the excavation of the loins, and produce symptoms of a chronic abscess, or of a *dépôt par congestion*, without any disease of the vertebral column being present. We examined a man yesterday, in whom all these phenomena were present. This subject, aged 28 years, was attacked in 1825 with dull and deep-seated pains in the right side of the thorax and in the corresponding hypochondrium. He was attended for fifteen days in the Hôtel

Dieu: the fever ceased, and the patient went out with an enlargement in the posterior part of the flank, under the last right rib. On the 10th of August he entered the Hospital of *la Faculté*: the tumour was then fluctuating, about the size of the fist, but the skin was not red. It was punctured on the 1st of September and six or eight ounces of flocculent and unhealthy pus discharged. On the 17th of October he died. We found the skin detached to the extent of four inches in circumference, the subcutaneous stratum destroyed, there was a canal of communication with the chest, before the twelfth rib, several others with the lateral parts of the posterior wall of the abdomen, and a purulent infiltration extended from the fossa iliaca into the posterior mediastinal space and the whole of the right side of the chest.

Sect. 5. The Iliac Fossa.

As this portion of the abdominal cavity appertains both to the posterior and lateral parietes, but does not belong exclusively to either, we make it a distinct section. We have separated it from the pelvis properly so called, because it is too intimately connected with the iliac region already described, and especially because it will permit us afterwards to pass in review the greater part of the abdominal viscera.

This fossa is bounded, superiorly, by the spine of the os ilii, where it presents a slight groove, which is deepest at its posterior part:—inferiorly, by the posterior margin of Pourpart's ligament; and internally, by the inner border of the *psoæ* muscles, or, in other words, by a line drawn from the sacro-vertebral angle to the spine of the os pubis. In its two external thirds, we observe a kind of excavation, fossa, or gutter, much deeper in the female than the male, which gradually becomes narrower as it descends and terminates in a small *cul-de-sac*, or rather groove which extends from the spine of the ilium to the external side of the iliac artery, just where this vessel is about to pass under Poupart's ligament. This groove is, below the the crural arch, what the external inguinal depression is above it: we will therefore call it the *external iliac fossette*. At the inner part of the iliac fossa there is a prominence, which is very large near the sacro-vertebral angle, but afterwards decreases until it reaches

the crural arch, where it limits the groove just mentioned, on the inner side of which we observe another groove bounded, anteriorly, by Poupart's ligament; posteriorly, by the linea ilio-pectinea; externally by the epigastric and external iliac arteries, and internally by the origin of the umbilical ligament. This excavation, which we will name the *internal iliac fossette*, is below the middle inguinal fossette and corresponds to the superior orifice of the crural canal. The prominence just mentioned runs along the brim of the pelvis, and separates the cavity of this basin from the iliac fossa properly so called: on the right, this fossa is filled by the cœcum; on the left, by the sigmoid flexure of the colon

CONSTITUENT PARTS.

I. *The Peritoneum.*

This membrane is very supple in the iliac fossa, and can be easily separated from the parts which it covers. It appears thinner than in the other regions, because the cellular layer which invests it is detached from it; it is adherent only where it approximates the spine of the ilium, so that it may readily be protruded before the viscera, and form for them an envelope, when they escape through the natural apertures of the abdomen.

II. *The Fascia Propria.*

Beneath the peritoneum we invariably find a considerable quantity of lamellated cellular tissue. In most subjects this tissue forms a membrane which sometimes assumes fibrous characters in a very evident manner, and which is, in reality, only the continuation of the sub-peritoneal cellular layer, which we have already so frequently pointed out under different appearances. If we commence with it in the middle of the iliac fossa, we will be able to trace it to the upper part of the spine of the os ilii, between the serous membrane and the transversalis muscle, but becoming more and more attenuated, and finally blending itself with the fascia transversalis. Towards the loins, that is, in ascending towards the kidneys, it is thicker and more supple, especially on the outer side of the internal eminence or of the psoas muscle.

As far as the posterior surface of Poupart's ligament, between the spinous process of the ilium and the iliac vessels, it remains very distinct, and is only adherent to the peritoneum and fascia iliaca by means of very extensible and supple cellular lamellæ, in which we frequently meet with large and soft adipose vesicles. As it passes over the anterior surface of the psoas, its laminæ separate to form a sheath for the spermatic vessels; it soon envelopes the ureter in the same manner, and likewise gives to the iliac vessels a complete tunic. When it arrives near the iliac *fossettes*, it gives off envelopes to the origins of the circumflex iliac, epigastric and umbilical arteries and the vas deferens. At this place it may be easily divided into two sheets; one of which ascends with the peritoneum and the vessels upon the internal surface of the transversalis muscle; the other, which is thinner, lines the bottom of the internal iliac *fossette*, is prolonged into the crural canal, and at length goes to lose itself on the one hand, in the fascia superficialis of the thigh, and, on the other, to expand upon the posterior surface of Gimbernat's and Poupart's ligaments, and is apparently continuous above the latter with the fascia transversalis.

Until the present time, the fascia propria has scarcely been noticed by anatomists. It is of importance, however, to understand it well, in order that we may comprehend in what manner it is related to the fascia transversalis, with which the sheet just spoken of has been frequently confounded; not that we ought to make of it a separate aponeurosis, for we think that these laminæ have already been sufficiently multiplied as distinct organs; but we have not sufficiently endeavoured to ascertain their continuity, and it is time to make some attempts for this purpose. Thus, is it not certain that all the aponeuroses are only modifications of the cellular tissue, and that we may derive them from a small number of centres? For example: we have already seen that all the fasciæ of the neck are continuous, by ultimate analysis, with the pericardium on the one part, and on the other, with the aponeuroses of the arm, which in their turn actually terminate upon the scapulo-humeral articulation; we have also seen that the sub-cutaneous cellular layer every where formed a true fascia superficialis, which can only be regarded as an appendage to the fibrous element, with which it has numerous points of con-

tact. With respect to the abdomen in particular, is not this superficial layer continuous, in a direct manner, with the sub-peritoneal sheet, by a multiplicity of apertures, and especially by the inguinal and crural canals? Finally, in order to give a distinct idea of the fascia propria in few words, we may say that it is, between the peritoncum and the parietes of the abdomen, only a repetition of the fascia superficialis between the parts covered by this layer and the skin: sometimes thin, at other times very thick; throughout the greater part of its extent single, in some points bifoliated; here adherent to and blended with other laminæ,—there, on the contrary, supple, distinct, and very easily isolated. In every point of the belly it varies in some one of its characters, but is always the same membrane; and it is by its means, on account of its continuity, that the fluid products of inflammation infiltrate and spread from one part to another with great facility, and this facility is always greatest where this layer is least compact.

III. *The Iliac Aponeurosis, or Fascia Iliaca.*

We may say that this is the continuation of the very thin membrane heretofore described as originating from the ligamentum arcuatum and the fibrous arch which embraces the origin of the psoæ, and is spread out over the anterior surface of these muscles. This membrane becomes gradually thicker as it descends into the iliac fossa, where its fibres generally run in a transverse direction. In this fossa, it is strong, dense and almost inextensible; near the spine of the ilium it splits into two laminæ, for the purpose of embracing the circumflex iliac artery. It is very adherent to the inner labium of this spine, where it is continuous with the fascia transversalis. Internally, upon the fleshy portion of the psoas, it is thinner, but increases in thickness upon its tendinous portion. When the psoas parvus exists, the fascia iliaca is confounded with its tendon, or rather, this tendon expands into the laminæ of this aponeurosis, and gives to it additional strength. It serves to bind down these muscles; is spread over them, and behind the iliac artery and vein; and is inserted into the brim of the pelvis, where it unites with the fascia pelvia. Inferiorly, it is thick also, and rises slightly in its external half, in order to attach

itself to the posterior border of Poupart's ligament, extending its insertion from the spine of the ilium to about eight lines on the outer side of the external iliac artery: it then abandons this ligament, and, in its internal half, is inserted into the crista of the pubis (*crête pectinée*),* and is again united to Poupart's ligament before it reaches the tubercle of the pubis (*épine du pubis*). As this aponeurosis is about to pass under the crural vessels it generally detaches one of its laminæ, which is spread over their anterior surface, thus forming a sheath for them which is soon confounded with that derived from the fascia propria: in other terms, the posterior border of Poupart's (ilio-pubic) ligament seems to expand and to give rise to two membranes, one of which ascends, applying itself to the internal surface of the transversalis muscle and forms the fascia transversalis; whilst the other sinks down upon the iliac fossa, to constitute the fascia iliaca; but this must be understood to relate to the external portion of the crural arch only. Indeed we may say, that, as Poupart's ligament is passing from the ilium to the tubercle of the pubis, it bifurcates about the middle of its length, in such a manner that the superior branch of this bifurcation, or Fallopius' ligament properly so called, follows its primitive direction, and goes to the pubis, forming, by its superior border, the external pillar of the inguinal ring; whilst the inferior border of its extremity, in attaching itself to the bone, expands, and prolongs its attachment from the tubercle of the pubis one inch outwards and backwards upon the linea ilio-pectinea (*crête pectinée*), in order to constitute Gimbernat's ligament. The inferior sheet of this bifurcation sinks down upon the psoas and iliacus muscles, and when it arrives near to the vessels it passes behind them, and following the body of the pubis rejoins the expansion of Poupart's ligament. In consequence of this disposition a broad elliptical opening is formed, which constitutes the abdominal aperture of the crural canal. In short, it seems that the iliac and transverse aponeuroses circumscribe a large funnel,† wanting its internal half, the pipe of which is rep-

* As the *crista of the pubis* is a name frequently given by English anatomists to the spine or tubercle (*tuberculum ossis pubis*), it is necessary to state that it here refers to that sharp ridge which forms the posterior and superior margin of the horizontal ramus of the os pubis.—*Transl.*

† Colles, p. 63.

resented by the crural canal and opens into the groin; so that the fascia ilica is actually continuous with the deep sheet of the fascia lata, as it passes upon the body of the pubis and the anterior surface of the pectinalis muscle. If we take the precaution to remove all the parts which fill the crural canal, in order to examine its superior orifice, we will find that this opening is formed, anteriorly, by the slightly concave margin of Poupart's ligament; posteriorly, by the iliac aponeurosis and the deep sheet of the fascia lata, just where these two laminæ unite at the crista of the pubis, or upon the anterior surface of the psoas and iliacus muscles. This last half of its circumference is much more concave than the first: externally, it terminates by a pretty acute angle, which results from the bifurcation of Poupart's ligament; finally, it is limited internally by a semi-lunar concave border, which appertains more especially to the expansion of the external pillar of the inguinal ring upon the linea ilio-pectinea, or to what is called Gimbernat's ligament. This ligament, so incorrectly described by Gimbernat in 1793, in a *Treatise on Crural Hernia*†, is not, therefore, a particular organ possessing a separate existence, but only, as M. Boyer has said, an expansion, a species of reflected lamina of Poupart's ligament. As it is necessary, however, to have a distinct idea of it, in order that we may comprehend its exact relations with crural hernia, we will consider it as if isolated, and, in this case, it will represent a small triangular membrane, its anterior border continuous with the posterior margin of the external pillar of the inguinal ring, its posterior border inserted into the linea ilio-pectinea, and its base presenting the concave margin which we have just mentioned: consequently its apex will correspond to the tubercle of the pubis, whilst its broadest margin will form the internal boundary of the opening of the crural canal. This last border is generally free, thin and cutting; it is this which a great many surgeons, since the time of Gimbernat, have advised the division of, in strangulated crural hernia; but sometimes it is continuous with the two laminæ of the fascia lata, so that its superior surface is inclined downwards and outwards, as if to form a gutter, which then completes the funnel which the crural canal naturally represents.

* *Nuevo Metodo de operar en la Hern. etc.*, por D. A. Gimbernat. Madrid, 1793.

The transverse diameter of this opening is about two inches, frequently two inches and a half in the female : its greatest antero-posterior diameter, from ten lines to an inch, which gradually diminishes as it approximates its extremities. It is naturally divided by the crural vessels into two portions. The internal portion is the broadest, and has received the name of the *crural ring*. It is triangular, wider externally than internally ; bounded, on the pubic side, by the concave cutting edge of Gimbernat's ligament ; anteriorly, by Poupart's ligament ; posteriorly, by the linea iliopectinea, and externally, by the crural vein, the external iliac, and epigastric arteries. It generally encloses a lymphatic gland, a prolongation of the fascia propria, and some adipose vesicles, which almost completely block it up : it gives passage to the viscera in crural hernia. The external portion is triangular also, but much narrower, and is bounded anteriorly by Poupart's ligament ; posteriorly, by the fascia iliaca, where, becoming continuous with the fascia lata, it is about to pass into the thigh upon the anterior surface of the iliac and psoas muscles ; externally, by the angle formed by the union of the iliac aponeurosis with Poupart's ligament ; and internally by the femoral and epigastric arteries. Most anatomists in describing the crural canal, have neglected this portion, confining their attention solely to that which is on the public side of the vessels. It is true that it possesses much less interest, because it has never been proved that herniæ ever escape through it. We will indeed find, when we come to describe the inguinal region, that the anatomical disposition of the parts satisfactorily accounts for the position of the displaced viscera before and even external to the crural vessels, notwithstanding they may have actually protruded from the abdomen by passing between the crural vein and the base of Gimbernat's ligament. However, previous to the investigations of Scarpa, it was generally admitted that the organs might protrude either before, external to, or on the pubic side of the artery ; or rather, it was stated, in an indefinite manner, that they might escape between the vessel and the crural arch. At present, no person participates in this error : but has not Scarpa gone too far in saying that external femoral hernia is impossible ? We have frequently examined this point of the crural canal upon the dead body, and have always found that, by sliding the extremity of the finger from

without inwards along the posterior surface of Poupart's ligament, it would fall into the external iliac *fossette*, that is, on the external side of the artery, so that we might with a gentle effort, push it into the crural canal along the iliac side of these vessels. It must be admitted, however, that hernia is of very difficult occurrence at this point : 1st, because the excavation which leads to it is very superficial ; 2d, because the space is extremely narrow ; 3d, because the viscera will slip into the internal *fossette* sooner than separate and drive inwards the femoral artery. But sometimes the epigastric artery forms a greater prominence than usual in the iliac fossa, and thereby increases the depth of the external iliac *fossette* so much, that the displacement might, at least, commence externally ; and the possibility of such a disposition is worthy of note, for it is evident that, in a case of this nature, in cutting the stricture inwards, we would inevitably divide the epigastric artery, which would then surround the internal half of the circumference of the neck of the sac. The internal iliac *fossette* is, on the contrary, very well calculated to admit of the escape of the viscera : 1st, because it is much deeper and broader ; 2d, because between the femoral vein and the semi-lunar edge of Gimbernat's ligament a space exists, which will readily admit the thumb and even a larger body—a space which is filled only by cellular tissue, and sometimes a lymphatic gland, substances affording but a very feeble resistance ; 3d, because, when the hernia has once commenced, the vessels may be displaced to a certain extent, and repelled even to the external angle of the crural ring ; 4th, because it is the most dependent point of the iliac fossa, and consequently that to which the action of the muscles has a constant tendency to propel the viscera. Therefore from anatomical inspection, we may conclude that external femoral hernia is a possible occurrence, but that it must be extremely rare ; that the internal is the only one which has been observed ; and that, in this species, the protrusion almost always takes place at the *fossette* which separates the umbilical ligament (*artère*) from the epigastric artery, because in the small number of cases in which it commences by the internal inguinal *fossette*, the organs protrude through the external opening of the inguinal canal.

Recapitulation. The crural ring is a broad opening, of greater extent transversely than from before backwards ; broader in-

ternally, because its pubic angle is rounded off by Gimbernat's ligament, than towards its iliac angle which is generally very acute, and includes the iliac artery and vein. It is divided by these vessels into two portions ; one, which is internal to the vein, triangular, blocked up by cellular tissue and a lymphatic gland, comprising half of the opening, and constituting the proper orifice of the crural canal ; the other external, triangular likewise, but principally occupied by the crural vessels, which leave on the iliac side only a small space filled by a pretty dense cellular tissue.

IV. *The Muscles.*

The iliac fossa contains the *psoæ* and iliac muscles.

(a) The *psoas parvus* presents for consideration, in this place, its tendon only. It should be observed that, on account of its relations with the fascia iliaca, some authors have considered this aponeurosis as a mere expansion of the tendon of this muscle ; but, in order to prove that it is an accessory organ only, it is sufficient to state that, when the *psoas parvus* is wanting, this fibrous membrane equally exists. Be this as it may, as this tendon descends it gradually expands, and is inserted, on the one hand, by means of the fascia iliaca, into the side of the margin of the pelvis ; on the other, into the linea ilio-pectinea : whence it follows that the principal action of this muscle is to stretch the aponeurosis of the iliac fossa, and indirectly the deep sheet of the fascia lata. For the same reason, it may assist in flexing the pelvis upon the spine, and should be relaxed when we attempt to reduce the hernia, or relieve its stricture, when strangulated.

(b) The *psoas magnus* forms almost the whole of the internal prominence mentioned in the commencement of this section. As it takes a direct course from the side of the sacro-vertebral angle to the crural arch, it consequently diminishes the bis-iliac diameter of the superior strait of the pelvis, and hence the indication for slightly flexing the thighs and legs during parturition. Its external border receives almost all the fibres of the iliac muscle ; so that these two muscles are confounded with each other in their passage under Poupart's ligament. The former being very thick superiorly, and the latter, on the contrary,

very thin, they thereby limit a groove, which gradually disappears in proportion as the two muscles become blended together. As the iliac muscle originates from the whole of the venter of the ilium, it is thin in its upper portion, but increases greatly in thickness previous to its passage under the crural arch.

Relatively to these muscles, the iliac fascia forms the anterior half of a species of sac open at its two extremities; that is to say, that it is inserted, externally, into the whole length of the spine of the ilium; internally, into the sides of the last lumbar vertebræ, and into the brim of the pelvis as far as the crista of the pubis (*crête pectinée*); inferiorly, into the posterior margin of Poupart's ligament, and superiorly, it is prolonged upon the *psœ* muscles, becoming more and more attenuated in proportion to its ascent; so that this sac, which is very broad in the middle, becomes narrower inferiorly, in order to descend into the thigh through an opening formed, on the one part, by the anterior border of the *os innominatum*, between its anterior and superior spinous process and the ilio-pectinated eminence (*éminence ilio-pectinée*);* on the other, by the external half of Poupart's ligament. This opening is elliptical, like that of the crural ring, to which it bears a resemblance in more than one respect, and from which it is separated only by that portion of the fascia iliaca which descends from Poupart's ligament upon the body of the pubis. It also has two angles: one external, more elevated, is situated near to the anterior and superior spinous process of the ilium; the other, internal, on a more inferior plane, falls upon the ilio-pubic eminence. It further resembles the crural sheath in becoming narrower as it descends, forming a species of canal. It is completely filled by the *psœ* and *iliacus* muscles, which pass through it to their termination at the trochanter minor, and also gives passage to the anterior crural nerve and the inguino-cutaneous of the lumbar plexus. The superior opening, which is much more irregular, is filled by the *psœ*, and is pervious only on the outer side of these muscles, because the sheet of the fas-

* The *ilio-pectinated eminence* is observed at the superior and anterior part of the *os innominatum*, above the cotyloid cavity. Its direction is oblique from without inwards and from behind forwards, and it is formed by the junction of the base of the *os ilium* with that of the pubis. *Anatomie de Sabatier*, vol. 1, p. 134. *Bichat Anatomie Descriptive*, vol. 1, p. 190. *Portal Anatomie Medicale*, vol. 1, p. 337. We will hereafter call it the "ilio-pubic eminence."—Transl.

cia iliaca, which abandons the spine of the ilium in order to rise over the psoæ, is continued upon the anterior surface of these muscles throughout the whole of the lumbar region. Posteriorly, it is bounded by the ilio-lumbar ligament, the transverse process, and the lateral portion of the last lumbar vertebra. Finally, in order to penetrate into the iliac canal, without lacerating the fascia iliaca, it would be necessary to introduce the finger between the quadratus lumborum, the psoas and the posterior curvature of the spine of the ilium.

We may now readily perceive that the muscles of the iliac fossa are firmly bound down in this species of canal, and that they can contract without communicating their movements to the digestive organs situated before them. We also see how the fibrous sheet which covers the psoas, unites the fascia iliaca to the ligamentum arcuatum, and consequently, to the aponeurosis of the transversalis muscle; that a long fibro-osseous canal extends from the diaphragm to the trochanter minor, which is thin in its superior fibrous portion, where it is spread over the psoas muscle; depressed in the middle, where it is expanded over the iliac muscle, and terminates in a point without the pelvis, where we will again recur to it.

It is important to recollect this arrangement, inasmuch as it gives us a clew, by means of which we may be enabled to discriminate between the different kinds of *dépôts par congestion*. Thus, it is well known that the pus, which results from vertebral caries, frequently descends and forms an abscess in the groin, and that it then penetrates through the cellular tissue of the loins and of the iliac fossa: but authors have omitted mentioning that it may descend along the fascia propria, between the peritoneum and the iliac fascia, when it must make its escape from the pelvis by the crural canal, rather than by passing through the canal which has just been described. In the first case, we include every infiltration and sub-peritoneal suppuration, as well as the products of affections of the vertebræ; but they rarely produce an abscess in the thigh, because the fluids are more disposed to infiltrate into the cellular tissue of the pelvis than to pass through the crural canal. In the second, to which appertain the consequences of *psoïtis*, of the deep caries of the vertebræ. not only of

the lumbar region, but likewise of the dorsal portion, the pus insinuates itself under the fascia iliaca through the superior aperture, and follows the iliac muscle, without being able to make its escape otherwise than by the external opening of the crural arch. unless it should penetrate the different sheets of the transversalis muscle, above and on the outer side of the ilio-lumbar ligament, where they are naturally thin and sometimes transformed into simple cellular lamellæ, and make its appearance under the skin of the loins. For the same reason, when deep-seated abscesses of the loins disappear, in order to take their course to the groin, they pass into the iliac fossa, under the fascia iliaca. We will have occasion to pursue the investigation of this subject when we come to treat of the inguinal region: but we may premise that abscesses of the first species are more particularly consequent to inflammation of the cellular tissue, or of the soft parts in general, and not necessarily connected with affections of the bones; whilst those of the second, which are more common, generally attend upon caries of the vertebræ.

v. *The Arteries.*

The *iliac* arteries result from the bifurcation of the aorta, and consequently originate opposite to the intervertebral cartilage of the fourth and fifth lumbar vertebræ; sometimes a little above, at others a little below this point. Pestche, cited by F. Meckel, has seen them separate from the aorta very near the diaphragm. From their origin, they pass in a divergent manner upon the body of the pubis, so that their direction may be pretty accurately represented by a line dropped from two inches below the umbilicus upon the middle of Poupart's ligament. As far as the posterior border of the body of the pubis, the length of the artery of the left side is four inches and a half, whilst that of the right side is five inches: to the middle of Poupart's ligament it is half an inch more. This difference in length is owing to the aorta being situated upon the left side of the spine until its bifurcation. The first, in abandoning the sacro-vertebral angle, makes a considerable curve, which extends a little beyond the sacro-iliac symphysis, the convexity of which is turned backwards and slightly outwards; afterwards, it makes a longer but much gentler curva-

ture, which is bent in an opposite direction, and extends to the middle of Poupart's ligament. After the iliac arteries have run to the extent of two or three inches, they divide or bifurcate in their turn: thus far they are called common or primitive iliacs, and of the two branches resulting from this division, the one is the internal or pelvic iliac, the other the external or crural iliac. The point at which this bifurcation occurs is not always the same; generally it is between the sacro-iliac symphysis and the sacro-vertebral protuberance, sometimes upon the symphysis itself, and in other cases upon the body of the vertebra. It is seldom that this bifurcation does not take place, on the right side, somewhat nearer the spine, whilst on the left it is less remote from the sacro-iliac symphysis; which may be the case without the absolute length of the primitive iliacs being greater on the one side than on the other, because the artery of the right side is obliged to pass over a greater space before it reaches the sacro-iliac junction. It follows, however, from this disposition, that the external iliac arteries are of different lengths, the right being nearly an inch longer than the left. Although these varieties of origin might, at first sight, appear of but little consequence, they would nevertheless be in reality very important, if it was possible to ascertain them during life, when we wish to tie one of these arterial branches. It is indeed evident, if the disease requires the application of the ligature pretty high up, that the danger would be so much the greater the lower the bifurcation existed, and *vice versa*. It is also evident, from this circumstance, that the ligature of the right external iliac affords a greater probability of success than that of the left, but that the performance of the same operation upon the internal iliac artery of the right side would be attended with much greater difficulty. From the aorta as far as the crural arch, the iliac arteries are enveloped in a sheath of considerable strength, which they derive from the fascia propria; a sheath which is thicker before than behind, much stronger below than above, and in which the vein is also included. Externally, they lie upon the fascia iliaca, which separates them on the inner side from the psoæ muscles; posteriorly, we find the vein which is in contact with them, and the obturator nerve; anteriorly, they are covered by the peritoneum, crossed by the ureter opposite to the sacro-iliac symphysis, and by the vas deferens near the crural

arch. Frequently also the *génito-crural* nerve, or one of its branches, creeps along the anterior and outer surface of the artery, included between the laminae of its external covering. This small cord deserves particular attention, in order that it may be avoided when tying the vessel, which is likewise surrounded by lymphatic vessels and glands.

Of all these relations, the most important are those which exist between the artery and vein, between the artery and the sheath formed by the fascia propria, because in order that the former may be properly tied, it is necessary to avoid the second and divide the latter. But we will resume the consideration of this point after we have passed in review every thing relative to the artery.

The primitive iliac, previous to its bifurcation, sometimes gives off the ilio-lumbalis artery, which immediately glides between the sacro-iliac gutter and the iliac and psoas magnus muscles, in order to ramify principally in the iliac fossa, where it anastomoses with the circumflex iliac, and, a little higher, with the last lumbar branches ; so that, in case the aorta was obliterated just above its bifurcation, this artery would perform an important office.

Another much more fortunate disposition, if it existed in persons requiring this operation, would be that in which a renal artery originates from the iliac ; an occurrence which we have sometimes met with.

The small capillary vessels which it afterwards distributes to the cellular tissue and lymphatic glands, are of no importance in surgery. The same may be said of those given off by the external iliac until within a few lines of its termination, where the epigastric and circumflex iliac arise ; which we will now examine at their origin.

(*b*) The *epigastric* artery generally originates from the anterior and internal part of the external iliac, on a level with the crista of the pubis. It seldom arises by a common trunk with the circumflex iliac, but it may come off at a lower point than the one just indicated : we have seen it originate from the femoral, and even from the profunda. Sometimes also we find it given off in the iliac fossa, as much as an inch behind the pubis. The first case would increase the danger of tying the crural artery, in the upper part of the thigh, between Poupart's ligament and the

origin of the profunda; but it would be more favourable for the ligature of the external iliac. The second, on the contrary, might render the latter operation dangerous, and would favour the success of the former. Indeed, it is almost proved to a certainty, that a ligature applied around a large artery, a little below the origin of a considerable branch, is liable to cut through the vessel before its obliteration is complete and solid, because this branch will turn off the current of the blood above and thereby prevent the formation of the adhesive coagulum; so that it would be very dangerous, for example, to tie the external iliac artery between Poupart's ligament and the origin of the epigastric, which might readily happen when the latter branch is given off higher up than usual. This operation was performed by Bécларd, in 1822, at the Hospital of La Faculté. On the fourth day the patient died from hæmorrhage, and it was ascertained that the ligature had cut through one half of the external iliac artery two lines below the origin of the epigastric.

The epigastric artery, immediately after its origin, descends a little obliquely inwards, until it arrives opposite to Poupart's ligament, then ascends behind this ligament, describing a quarter of a circle around the inferior and internal portion of the spermatic cord.

We have already considered the relations of this vessel with the neck of the sac in inguinal herniæ; it remains for us to speak of those which it contracts with crural hernia. Thus, when the viscera pass into the crural ring, the external semi-circumference of the tumour, is always embraced, from behind forwards, by the external iliac vein, the artery of the same name, and the origin of the epigastric vessels; so that, if we should attempt to remove the strangulation, by dividing the stricture outwards and backwards, we might kill the patient by wounding the large arterial trunk; and that if we attempt to dilate it upwards and outwards, it will be quite as difficult to avoid the epigastric artery: it is towards the internal semi-circumference of the tumour then, that the edge of the bistoury must be directed in this operation, in order to avoid hæmorrhage. But, on this side, the epigastric artery sends off two branches, which merit our attention; one, which follows the posterior surface of Poupart's or of Gimbernat's ligament, in order to cross the symphysis of the pubis;

the other, which is frequently given off from this branch, crosses the posterior surface of the same ligament in its descent towards the obturator foramen. The origin of the first of these branches is sometimes a few lines lower, at others a little higher than usual; whence it follows, that in taking its horizontal course towards the pubis, it may run along the inferior border of Gimbernat's ligament, or pass parallel to, and even above its superior margin;—so that, in crural hernia, it will turn round the inferior part of the neck of the sac, in the first case; whilst, in the other, it will pass upon its anterior semi-circumference. It is the latter disposition which has alarmed surgeons, when dilating the stricture, and has induced them to cut inwards, instead of vertically, or parallel to the linea alba. But, when this branch does not give off the obturator artery, it is seldom so large as to cause any apprehension from hæmorrhage. However, Mr. Hey, in his *Surgical Observations*, relates a case cited by Scarpa, in which he says that he wounded the epigastric artery in dilating the stricture upwards, and that the hæmorrhage was easily arrested by introducing small pieces of sponge into the wound. As the patient recovered, there was no positive proof of what had happened; but it appears evident, as Scarpa observes, that the epigastric was not the artery which was wounded, since it is almost uniformly on the external side of the sac in crural hernia; it is also very difficult to believe, with the latter author, that it was the obturator originating from the epigastric or crural artery, but think that it was merely the branch which we are now describing, of greater dimensions than usual.* It is, in fact, very doubtful whether compression alone would have prevented a recurrence of the hæmorrhage, if it had been derived from either of the arteries indicated by these two authors.

The second branch is as frequently derived from that which we have just described, as from the trunk of the epigastric itself; but it is detached from it sometimes nearer, sometimes more remote; so that, in crural herniæ, it will run to gain the obturator foramen, in embracing the external part of the neck of the sac in one case, whilst in the other, it will turn upon the internal side of it, unless the branch which furnishes it does not itself pass

* *Supplement au Traité sur les Hernies, de Scarpa, traduction de M. Ollivier, page 84.*

below the tumour. In the latter case, which is fortunately the most frequent, the whole of the internal and superior part is found free from arteries; so that, in the female, in whom the spermatic artery does not inspire any dread, we may with perfect safety dilate the stricture in this direction. In the first, on the contrary the neck of the sac is surrounded by an arterial circle almost complete: but now, the small artery under consideration is that which constitutes the obturatrix when this arises from the epigastric; so that, in a similar circumstance, it would at first sight seem impossible to avoid a serious hæmorrhage in the operation for crural hernia.

It is long since anatomists have noticed this common origin of the epigastric and obturator arteries; and **Monro** was the first who attempted to ascertain in what proportion these cases existed. This celebrated surgeon supposed that this anomaly occurred once out of twenty times: **Burns** met with it upwards of thirty times; **Hesselbach** considers it a rare occurrence; **Scarpa** and **Lawrence** state the proportion as one in ten or fifteen; **M. J. Cloquet** one out of five; and **F. Meckel** says that it is met with almost as frequently as the normal state. Our own observations induce us to concur with **Monro**. Be this as it may, it is easy to comprehend in what manner this anomaly in the origin of the obturator artery takes place. In the very young fœtus, this branch consists of two twigs of nearly equal volume: one of these twigs is derived from the internal iliac (*hypogastrique*); the other from the external iliac, or the epigastric; both will persist after birth, and in the adult; but one of them will remain stationary with respect to its growth, whilst the other will enlarge in proportion to the developement of the organs to which it is distributed. Now, if contrary to the regular order, the branch from the internal iliac is stopped in its developement, the obturator will appear to originate from the epigastric.* We see then that this disposition is almost natural: it must only be observed that, in the greater proportion of these cases, when the obturator artery originates from the epigastric, it is driven outwards and backwards by the viscera which protrude in femoral hernia, and that it will pass above and on the inner side of this

* **Meckel**, *Manuel d'Anatomie*, etc., tome 2d, page 448.

tumour only when the pubic branch, properly called, shall form its trunk of origin, and shall itself be derived from the epigastric at a pretty considerable distance from the external iliac.

In a case of double femoral hernia existing on the same side, Burns found the obturator artery descending between the necks of the two tumours; so that the stricture of one of them might have been dilated inwards without danger, whereas the same direction of the incision in the other, would almost inevitably have been attended with hæmorrhage.

Even when the obturator artery turns over the superior surface of the hernia in passing towards its destination, it does not necessarily follow that it will inevitably be divided by cutting upon the concave margin of Gimbernat's ligament. On the contrary, its anatomical relations (with respect to the hernia), and observation, prove that it may be, most frequently, avoided. In fact, this fibrous border, in crural hernia, is generally very much inclined towards the thigh; the vessels are likewise more or less removed from the circumference of the crural ring by the viscera which traverse it, and they are naturally enveloped in the fascia propria, which keeps them at a certain distance from the posterior face of the external pillar of the ring or of the inguinal ligament of Gimbernat: so that, even under the most unfavourable circumstances, it will almost always be possible to cut upwards or inwards, to a sufficient extent, without wounding the arterial circle which circumscribes the neck of the hernia. The danger will also be less when the obturator arises from the epigastric near to its origin, or when the latter vessel is detached from the external iliac at a greater distance behind the crural arch: when, on the contrary, they originate together from the femoral artery itself, that is to say, between the crista of the pubis and the origin of the profunda, if the obturator did not pass between the tumour and the pectinalis muscle, if it ascended upon the anterior face of the neck of the hernia, we conceive that, as it is much nearer to the seat of the stricture, it would be much more exposed to the action of the instrument.

Finally, there is also another anomaly, with which it is important to be acquainted: it is when the epigastric arises from the obturator or some other branch of the internal iliac. This disposition has been met with by Monro; and another very remark-

able example of the kind is delineated in a late work by Hesselbach. F. Meckel, who considers the latter author to be under a mistake in this respect, had doubtless not seen the beautiful plates in which he has represented it. When this anomaly exists, it will be the more detrimental, because the tumour will be free from arteries upon that side only at which we never dilate the stricture; for, of whatsoever species the hernia may then be, the epigastric artery will equally cross its internal surface. But we are disposed to believe that, even in such a case, the artery will be so far from the circumference of the crural ring, as not to be very much exposed to the edge of the bistoury, if it is not carried farther than is absolutely necessary.

(c) The *circumflex iliac* is also given off from the external iliac artery previous to its entrance into the crural canal: it generally arises opposite to the epigastric, that is, from the anterior and external part of the crural artery. This origin is much more constant than that of the epigastric, and it requires the same precautions when it becomes necessary to apply a ligature around the external iliac artery. Immediately after its origin it passes outwards, and traverses the external iliac *fossette*, in ascending towards the anterior and superior spinous process of the ilium. When it arrives almost to the external angle of the great crural aperture, it perforates the fascia iliaca, which splits near its attachment to Poupart's ligament, in order to form a sheath for this vessel; beyond the spinous process of the ilium the circumflex iliac artery follows the curvature of the iliac spine, and the aponeurotic sheath persists. From the concavity of this arterial arch a considerable number of branches originate, which inosculate with the ilio-lumbalis; whilst others are detached from its convexity, in order to ramify in the abdominal parietes. This artery is sometimes double, in which case the largest branch generally ascends almost perpendicularly in the walls of the belly: we have already mentioned that this anomaly might render the operation for external inguinal hernia and paracentesis abdominis dangerous. The circumflex iliac artery, in traversing the external iliac fossette, is always more closely approximated to the iliac fascia than to the crural ligament; so that, if the viscera should actually protrude at this part, the neck of the hernia would be surrounded, internally, by the external iliac and epigastric arteries: anteri

only, by the vas deferens; externally, by the spermatic artery, and posteriorly, by the circumflex iliac. To these we may also add, directly upon its anterior part, the entire spermatic cord, which would be separated from the neck of the sac only by the thickness of Poupart's ligament, which is generally very thin in this situation.

But it is necessary, in this place, to give a cursory description of the relations of the spermatic cord with the crural canal, especially as it respects the spermatic artery.

(*d*) The *Spermatic artery* originates from the aorta or the renal artery, descends in the fascia propria upon the anterior surface of the psoæ muscles, as far as the posterior surface of Poupart's ligament, without presenting much interest, in a surgical point of view; by degrees it approximates the vas deferens and ascends to the opening of the fascia transversalis, through which it passes into the inguinal canal. It is here that it becomes important in man, relatively to crural hernia. Indeed, the spermatic cord is disposed in such a manner that, on entering into the inguinal canal, it is situated at the iliac side of the crural hernia, whereas on making its exit from the external ring, it is on its pubic side; so that it crosses the whole of the superior part of the tumour, and by cutting upwards the spermatic artery might be divided. Arnaud, who states that he lost a patient in consequence of this division, and relates the occurrence of a similar accident under another surgeon, was so convinced that the hæmorrhages which had been attributed by others to a wound of the epigastric, arose from the section of the spermatic artery, and of the impossibility of dividing it in incising vertically, that he afterwards preferred raising the crural arch with a crotchet, and dividing the neck of the sac with the scissors, to making use of the bistoury. Sir A. Cooper and Scarpa have since participated in these apprehensions, and the opinion of these two celebrated surgeons is at present almost universally adopted. It is for these reasons, that the former has advised making an incision through the aponeurosis of the external oblique, above and parallel to Poupart's ligament, drawing the spermatic cord inwards and backwards (by means of a bent probe) and afterwards passing a grooved director behind and below the crural ligament, in order that the bistoury may be more safely introduced upon it:—that the latter,

together with Gimbernat, Boyer, and most modern practitioners, prefers dividing the triangular expansion of the external pillar of the ring, by directing the edge of the instrument inwards and downwards, towards the spine of the pubis, that is to say, parallel to the direction of the crural arch. This last method of operating most certainly deserves the preference in man, and even in women, inasmuch as there is no artery in this direction which it would be dangerous to wound; whilst externally, we will find the epigastric in both sexes; and anteriorly, we run the risk of dividing the spermatic cord or artery in the male, and the pubic branch in both sexes. But it seems to us that there is not so much cause for apprehension as Scarpa, A. Cooper, etc. seem to believe; and, most assuredly, the former has too greatly magnified the dangers which would attend on making the incision in any other direction than that which he advises. Gunz certainly erred, when he affirmed, in opposition to Arnaud, that the spermatic artery could not be wounded unless Poupert's ligament was completely divided; for, as we have seen, this ligament is hollowed out into a groove, in the bottom of which groove the artery takes its oblique course, and in such a manner that it is situated a little nearer the neck of the hernia than would, at first sight, be imagined; but this groove also becomes gradually effaced, in proportion as the external pillar of the ring approximates the spine of the pubis, and this pillar itself gradually increases in width; so that, if we should cut from below upwards upon its inferior margin, near its internal extremity, we would not actually reach the spermatic cord and its vessels, unless we made a much more extensive incision than is useful in the greater proportion of cases. Sabatier recommends dividing the stricture in the direction of a line which would terminate at the umbilicus; and we do not find that he was very apprehensive of hæmorrhage, or of wounding the spermatic artery. Even externally, where the latter vessel, and uniformly the epigastric trunk are met with, observation has proved that the operation was rarely followed by hæmorrhage. Therefore, Sharp operated for crural hernia in both sexes, in the same manner as for inguinal hernia,—that is to say, he cut outwards and upwards towards the flank. We know that M. Dupuytren follows the same method; and the recent editors of Sabatier assure us that hæmorrhage

is never the consequence of it. There is, however, one essential peculiarity in M. Dupuytren's mode of operating, which consists in his using a bistoury with a convex cutting edge, or Pott's bistoury reversed, which enables him, he says, to overcome the stricture before the instrument has penetrated so far as the epigastric vessels, which are enveloped in the sub-peritoneal cellular tissue; and, on the other hand, it would appear, from the obliquity of the incision, that the spermatic cord must be out of the way of injury. It is evident, that in adopting this idea, the straight bistoury of B. Bell might be used with greater facility and safety than that of Prof. Dupuytren; and we think that the point of the common bistoury would answer the purpose still better. In all cases, it would be more prudent to carry it upon the base of Gimbernat's ligament than upwards and outwards; for it is clear, that if the arteries are at all in danger, we will find them in the latter direction: whereas inwards, it is only where the obturator, originating from the epigastric, passes over the neck of the sac in its way to the obturator foramen, that hæmorrhage will be liable to happen. We may further remark that the cord, loosely enveloped in the inguinal canal, will be repelled by the pressure of the instrument more easily than it will be divided, and that the spermatic artery itself is pretty generally of too small a calibre to give rise to a very serious hæmorrhage. We may conclude then, that if Gunz appeared too confident of avoiding this vessel, Arnaud and Scarpa, on the other hand, have greatly exaggerated the chances of wounding it.

(e) In addition to the epigastric and circumflex iliac arteries, we sometimes, though very seldom, find a Renal branch originating from the external iliac. During the last winter we met with an anomaly of this nature on the right side; the kidney was very large; it received its emulgent artery from the aorta as usual, and the external iliac also sent to it another of almost equal volume. Such an arrangement would be very favourable if we were obliged to tie the trunk of the aorta, but it might be very dangerous if it should become necessary to put a ligature around the external iliac, at a certain elevation.

In order that the external iliac artery may be tied with safety, it is absolutely necessary to know exactly the disposition of the

organs which surround it at its entrance into the crural canal. We will therefore resume the consideration of it for a few moments.

In the first place, as the external iliac artery is passing upon the body of the pubis, it forms a slight curvature, the convexity of which is directed forwards; whence it follows that this artery, behind the crural arch, lies deeper the nearer we approximate its origin; it is upon the fore part of it that the peritoneum is reflected from the iliac fossa upon the posterior surface of the fascia transversalis, forming a *cul-de-sac*, which leaves a space of several lines between the opening of the crural canal and the peritoneum, a space which is filled by a lamellated and very extensible cellular tissue. At this point the application of a ligature will be less dangerous than elsewhere: but we must pay attention to the origins of the circumflex iliac and epigastric arteries, which should be left before, and the vas deferens, which must be pushed behind, if it approximates too near the point at which we wish to tie the vessel: the suppleness of the cellular tissue will admit a ready separation of the peritoneum, if it is necessary to carry the ligature a little higher; but it must be recollected that the seminal duct, in descending from the abdominal orifice of the inguinal canal into the pelvis, crosses the artery which we are about to obliterate. The cellular sheath which envelopes the artery is very dense in this situation, and appertains entirely to the fascia propria: it should be torn by the nail or grooved director, and the aneurismal needle passed upon the pubic side of the artery; then by moving it to and fro, the vein will be readily separated; whereas if we introduce the needle at the iliac side of the artery, there will be great danger of perforating the vein. We must also be particular in excluding from the ligature the femoral branch of the genito-crural nerve, which almost always passes to the thigh through the external portion of the crural ring, and which is sometimes enclosed in the laminae of the sub-peritoneal tunic of the artery.

Among the methods adopted until the present day for tying the external iliac artery, there are three in particular which we ought to mention:

1st. That which Abernethy adopted, when this operation was first performed, and which consists in making an incision parallel to the course of the artery, above Poupart's ligament, cannot be

generally followed, as it is liable to wound the spermatic artery, the peritoneum and the spermatic cord. In his subsequent operations he modified this process, that is to say, instead of directing the incision upwards and inwards towards the umbilicus, he carried it upwards and slightly outwards, and they have succeeded. In this manner the epigastric artery is more surely avoided, and the external iliac may be seized very high, which must always be done when this vessel is diseased as far as the superior part of Poupart's ligament : but then it is still pretty difficult to avoid the peritoneum and spermatic cord.

2d. That of Sir A. Cooper, who commences his incision within an inch of the anterior and superior spinous process of the ilium, carries it, in a semilunar direction, downwards to the upper part of Poupart's ligament, and again upwards, terminating it a little above the inner margin of the abdominal ring,—is attended with the serious inconvenience of making a wound which only falls upon the artery by its internal extremity ; the epigastric artery, however, and the spermatic cord are completely avoided ; besides, the peritoneum is very easily detached in the direction of this wound, since it is there connected to the ligament of Fallopius by a great abundance of cellular tissue.

3d. That of Bogros, which consists in making an incision parallel to the direction of the crural arch, in such a manner that the middle of it will correspond to the external iliac artery, is but a modification of Cooper's process, which differs from the second operation of Abernethy merely by the external extremity of the wound being situated lower down and nearer to the spine of the ilium. However, as the incision of Bogros crosses the artery at a right angle, it presents the advantage of exposing it more certainly ; but it requires greater address and precaution, on the part of the surgeon, relatively to the spermatic cord and epigastric artery ; nevertheless, by combining it with that of Cooper, that is to say, in extending the incision to an inch and a half internal to the anterior and superior spinous process of the ilium, it seems to us to deserve the preference. The following will then be the order and arrangement of the organs which it will be necessary to divide or avoid. 1st, The skin, which must be cut to the extent of three inches, commencing the incision half an inch above Poupart's ligament, carrying it parallel to the direction of this liga-

ment, and terminating it just above the superior angle of the external abdominal ring. 2d, The subcutaneous layer enclosing the superficial epigastric artery and its branch, which must be secured as soon as divided; some veins of considerable size, and fat in greater or less abundance. 3d, The aponeurosis (*tendon*) of the obliquus externus muscle, the fibres of which pass obliquely downwards and inwards to their insertion into Poupart's ligament; from which circumstance they cannot be simply separated, without being divided, except by following a method intermediate to those of Abernethy and A. Cooper. 4th, The obliquus internus muscle, and the cellulo-adipose membrane which separates it from the preceding aponeurosis. It is necessary to use great caution in dividing these parts, and to dissect from the iliac towards the pubic portion of the wound, for the spermatic cord runs along the internal third part of the incision, and is in danger of being wounded. As this layer varies in thickness in different cases, we will consequently reach the peritoneum more speedily at one time than at another; and as the division of it is one of the most dangerous steps in the operation under consideration, surgeons have advised laying aside the knife here, and tearing, with the finger or director, the soft muscular fibres of the internal oblique, as well as the cellular tissue which separates them, anteriorly, from the external aponeurosis, and posteriorly, from the fascia transversalis. In all cases, the divided parts, and the spermatic cord in particular, must be drawn upwards and inwards from the groove of Poupart's ligament. It must, nevertheless, be admitted that until we have got thus far in the operation there is no danger in making use of the instrument, since two membranes yet remain to be divided before we reach the peritoneum, especially if we confine the action of the knife to the external half of the wound, in order that we may the more certainly avoid, internally, the spermatic cord and the epigastric artery: these parts, being softer and more moveable, may be easily repelled, without laceration, by the finger or director. 5th, The fascia transversalis, which is so disposed, that it sometimes requires considerable force in order to lacerate it transversely, because its fibres fall perpendicularly upon Poupart's ligament, and by employing the bistoury, the peritoneum may be perforated. We here give the preference, however, to the cutting instrument; for

there is no doubt that the laceration, produced by the finger or director, will have a great tendency to produce suppuration and prevent immediate re-union. Therefore, in dividing the different layers which have just been enumerated stratum by stratum, it is very easy to cut the fascia transversalis, at least in its external portion, parallel to the direction of Poupart's ligament, and near its insertion into the posterior margin of this ligament. Or, we might trace the cord to the internal orifice of the inguinal canal, and then pass a grooved director through this opening, between the peritoneum and the fascia transversalis, whereby we will be able to cut the latter upon the conductor with the greater safety. We have previously observed that the pubic portion of this fascia is thicker than that which is situated on the iliac side of the cord; but it is never indispensable to divide it; if we wish to do so, however, in order to obtain more room, the cord should be pushed upwards and inwards, and it must be recollected that the epigastric artery lies directly behind. This last division is one of the principal inconveniences attached to the operation of Bogros; but this distinguished anatomist thinks that it should not excite apprehension; on the contrary, he considers that the epigastric will serve as a guide to direct us to the external iliac. 6th. The cellular layer, which is always easy to lacerate, and readily permits the peritoneum, covered by the *fascia propria*, to be pushed towards the pelvis; unless these laminæ are agglutinated, in consequence of previous inflammation, as occurred in the operation performed by Dr. Post.* The lips of the wound being separated, and the peritoneum thus pushed back, the arterial pulsations may be readily distinguished, and we will always find the external iliac artery behind Poupart's ligament, opposite to the inner margin of the posterior orifice of the inguinal canal. All that is then necessary, in order to seize this vessel, is to divide the *fascia propria* which envelopes it, either by tearing it with the nail, or cutting it with the point of the bistoury, in the same manner that we would make an opening into a hernial sac. At this step, the iliac vein, the spermatic vessels, and the vas deferens, which we separate inwards, demand the strictest attention. The ligature also, as we have already said, must be placed higher than the epigastric and

* Amer. Med. and Phil. Journal, vol. iv. p. 403.

circumflex iliac arteries ; indeed, less inconvenience would result from approximating the internal iliac, than from keeping too near the crural arch, if the arterial tunics were not perfectly sound below. Although in ascending towards the internal iliac there is no important organ to avoid, we should not do so, however, unless necessity requires it ; for we would be obliged to detach the peritoneum to a considerable extent, which would lay the foundation for a very extensive inflammation of the lax cellular tissue of the fossa iliaca and pelvis ; which constitutes one of the most serious inconveniences that could result from this operation.

As the operation of tying the external iliac artery has already been performed in Europe and America upwards of thirty times, and, in the majority of cases, with complete success, it is unnecessary to resort to argument in order to prove its advantages : we will only observe that the circulation will be afterwards carried on without difficulty, by means of the numerous anastomoses existing between the branches of the epigastrica superficialis, circumflex iliac, epigastric, and the intercostal, lumbar, ilio-lumbalis and internal mammary arteries ; between the external and internal circumflex and all the other superior branches of the femoral artery, and the gluteal, ischiatic, internal pubic and obturatorix arteries, etc.

VI. *The Veins.*

The number of the veins which we find in the iliac fossa equals that of the arteries ; but they are much more voluminous.

(*a*) The primitive iliacs, originating from the vena cava upon the right side of the fourth and fifth lumbar vertebræ, contract relations with the arteries which they accompany, which are somewhat different on the right side from those on the left ; and, in order to have an idea of this difference, as to their length and intimate relations, it is sufficient to transfer, in thought, what we have said of the artery of the right side to the vein of the left side, and *vice versa*. It will then follow, that the left iliac vein is obliged to cross the posterior surface of the commencement of the right iliac artery, and even of the aortic trunk, in order to place itself on the inner side of the left iliac artery, so that the external side of the latter is free throughout its whole extent.

The right iliac vein, on the contrary, is at first situated on the outer side of the right iliac artery, but passes gradually under its posterior surface in order that it may finally place itself upon its inner side before it reaches the crural ring. It is important to recollect this arrangement, in a surgical point of view. For we may readily see that if we endeavoured to pass a ligature around the inferior third of the right external iliac artery, we would readily succeed by sliding the blunt extremity of the needle under the pubic side of this artery obliquely outwards, and that the same method would be equally applicable to the whole length of the left external iliac artery, and even to the common trunk of this side; but on the right, it would be necessary to act differently, if we wished to avoid dangerous consequences: for, at two inches and more behind the crural arch, it would be very difficult to avoid perforating the vein, in attempting to pass the needle under the artery from within outwards, whilst, in the opposite direction, it would be much easier to separate these two vessels, because, on the side of the pelvis, the instrument would meet with no resistance. Finally, the veins are enveloped in the same sheath with the artery, and otherwise present the same general relations.

(b) The *Ilio-lumbalis* and *circumflex iliac* veins accompany the arteries of the same names; the two veins which accompany each epigastric artery are distributed in like manner, except that they do not form a curvature under the spermatic cord, because they descend directly upon the external iliac veins, which correspond to the centre of the internal abdominal ring. In consequence of this disposition then, it is evident that, if we attempted to tie the artery, we would be able to separate it more readily from its accompanying veins the nearer we approximated its origin.

(c) The *Spermatic* veins also accompany the arteries, which they considerably exceed in volume; there are always two, and often three, particularly in the female, in whom these vessels are called ovarian, and they sometimes form a complete plexus, which extends from the kidneys to the broad ligaments, especially after repeated pregnancies. In this sex, and sometimes in man also, the lumbar veins inosculate with the branches of the circumflex and ilio-lumbalis, and frequently constitute, in and above the iliac

fossa, another plexus called "*pampiniforme*," which must not be confounded with the preceding. The length of the ovarian and spermatic veins, the tenuity of their coats, and the softness of the tissues through which they pass, are so many causes which frequently predispose to their varicose enlargement.

We have already said that the ureter crosses the iliac artery opposite to the sacro-iliac symphysis, and that the vas deferens passes over the anterior surface of the external iliac artery, in descending from the inguinal canal into the pelvis. As these organs, with the exception of their position, present nothing remarkable here, we will not dwell any longer upon them.

VII. *The Lymphatics.*

This system is very abundant in the iliac fossa; the vessels are thick, short and numerous; their glands form a species of chaplet around the blood-vessels, and they are all enveloped in the *fascia propria*. Several of these glands lie directly upon the artery, and as they sometimes become gradually enlarged in consequence of various diseases, such enlargement might be mistaken for an aneurism; a mistake which might easily occur, both on account of the pulsations of the artery beneath being communicated to them, and the depth of their situation rendering their investigation difficult. One of these glands is almost uniformly situated in the crural canal, enveloped in a process of the fascia propria; and as this gland is generally very much elongated, it may project into the pelvis at the same time that it extends to the femoral opening of the canal, which it sometimes fills almost completely. The position of this organ renders it important, for should it undergo tumefaction, as it occupies a very confined space, it might give rise to serious consequences: thus, for example, it would compress the femoral vein or artery, and by impeding the reflux of blood through the former, occasion œdema of the limb; or by interrupting the arterial circulation, give rise to numbness or more or less acute pains. It may likewise form a tumour in the fold of the groin, which might be mistaken for a hernia.

VIII. *The Nerves.*

They are all derived from the lumbar plexus: at first imbedded in the fibres of the psoas muscle beneath the aponeurosis, they run for a longer or shorter time under this lamina before they perforate it.

(a) The *Inguino-cutaneous** nerve runs obliquely between the iliac fascia and muscle until it arrives near the anterior and superior spinous process of the os ilii; it even passes through the notch which separates this process from the anterior and inferior spine, and does not traverse the fibrous sheet until it reaches the thigh. Its deep situation prevents its compression, during obstinate constipations, by indurated fœces lodged in the cœcum or sigmoid flexure of the colon.

(b) The *genito-crural* nerve rests upon the anterior face of the psoæ muscles in the sub-peritoneal cellular layer, and runs parallel to the external iliac artery, generally on its external side, occasionally upon its anterior surface; so that sometimes it may be very easily avoided when tying this vessel, whilst, at other times it is so imbedded in the laminæ which cover it, that it would be dangerous to attempt to isolate it. In the latter case then, it would be better to seize it with the forceps and divide it, than include it in the ligature. If, however, it is already compressed by the noose, we should draw it tighter, in order that its function may be completely annihilated. Its two branches do not generally separate until they arrive near Poupart's ligament: the inguinal branch soon joins the spermatic vessels and vas deferens, and enters with them into the crural canal; the femoral branch follows the primary direction of the nerve, and enters into the external portion of the crural canal: but neither of them are so large as to be of any great importance in surgical diseases.

(c) The *Obturator* nerve descends perpendicularly under the

* *First Lumbar Nerve.* Its anterior branch receives a filament from the last dorsal pair, furnishes one to the second lumbar, communicates with the great sympathetic, and afterwards gives off three branches, distinguished into external or *ilio-scrotal* (Chauss.), into middle or *inguino-cutaneous*, and into internal or *sus-pubien* or *genito-crurale* of Bichat. (Marjolin, *Manuel d'Anatomie*. Vol 2d., p. 52).—*Transl.*

psoas, and pierces the aponeurosis which conceals the sacro-iliac symphysis, in order to pass across the pelvis, where it is situated behind the iliac artery and veins. We will see it again in the pelvic cavity.

(d) So with respect to the *sacro-lumbalis* nerve which unites the two plexus from which it derives its name, as it is crossing the fore part of the ala of the sacrum.

(e) The crural (*anterior crural*) is the principal nerve in this fossa. In descending, it isolates itself by degrees from the posterior face of the psoas muscle, so that, towards the inferior third of the iliac fossa, it is observed beneath the fascia iliaca, in the groove which exists between the psoas and iliacus muscles: thus far it is separated from the artery by the muscle under which it passes, but afterwards approximates so close to it, that at its entrance into the crural canal, the aponeurosis alone is situated between them: this membrane, however, is so very thick at this point, that in all operations performed upon the artery, the nerve may be easily avoided. We may further state that this nerve is enclosed in the same fibrous sheath with the psoas and iliac muscles, and passes with them under the crural arch, filling the internal angle of the iliac canal; and that the fibrous partition which then separates it from the artery, or from the crural canal, is prolonged even to the thigh, forming what M. J. Cloquet has named "*septum crurale*."

IX. *The Cellular Tissue.*

The cellular tissue of the iliac fossa is lamellated, abundant and very supple, encloses but few adipose cells, and forms two very distinct membranes; one which has been already described, is situated between the peritoneum and the *fascia iliaca*, passes through the inguinal and crural canals, and expands into the *fascia superficialis* of the thigh; the other, deeper, separated from the former by the iliac fascia, surrounds the muscles and the nervous trunk, is continuous with the deep or inter-muscular cellular tissue of the thigh by the iliac canal, and serves as a filter for the pus which accumulates in this member in the greater proportion of the *dépôts par congestion*.

x. *The Skeleton.*

This consists of the osseous portion from which the name of the region is derived, and consequently comprises the os ilium alone, which will be more particularly examined when we come to treat of the glutæal region. At present we will merely observe that the two iliac fossæ constitute almost the whole of what is called the *pelvis major*, which is much broader in the female than in the male, and this difference in breadth particularly relates to the sexual functions. The enlarged dimensions of the pelvis in the female cannot exist without a very extensive separation of the iliac spines from each other, which consequently occasions a greater elongation of the crural arch, and as the inguinal canal in this sex, is very small, it thence follows that crural herniæ are as frequent in women as inguinal herniæ are in men. A proof that such is the cause of this difference in the frequency of crural herniæ is, that in childhood, when the dimensions of the pelvis are similar in both sexes, inguinal herniæ are almost as common in young girls as crural. It sometimes happens that the iliac spines are declined backwards to such a degree that the whole of the ilium approximates the horizontal direction; or, in short, that the iliac fossa becomes plane, two examples of which, M. Ribes has met with in very aged females. Such a disposition would, in a special manner, favour the obliquity of the uterus during pregnancy, if it occurred in women young enough to become pregnant. It appears to us that this is owing to the constant, but gentle pressure which the viscera exercise upon the bones when feebly supported by the relaxed abdominal parietes, whether this relaxation is occasioned by the advance of age simply, repeated pregnancies, or emaciation subsequent to polysarcia or ordinary embonpoint, as occurs in many women towards the decline of life. When, on the contrary, the spines of the ilia, in the adult female, are more upright than usual, that is to say, when they have the same position as in man, they will favour the descent of the womb during gestation, unless the pelvic cavity, on its side, is diminished. In a well proportioned woman, the distance between each anterior and superior spinous process of the ilia should be ten inches, and eleven inches between the centres of

each iliac spine. But we will resume this subject after having examined the different regions of the pelvis.

The osseous fossa is so loosely connected to the iliacus muscle that it is easily denuded by suppuration, which accounts for the extreme facility with which necrosis or disorganization of the os ilii takes place after deep-seated inflammation of the cellular tissue, *psoriasis*, etc.; and hence the necessity for attacking these diseases vigorously in their commencement, if we wish to prevent the death of the patients.

Let us now give a glance at the different organs contained in the abdominal cavity.

Sect. 6. Of the Viscera.

(*a*) The *Liver*. This organ fills the whole of the right hypochondrium, and its left lobe extends also into the epigastrium, where it may easily be felt, in emaciated individuals or when enlarged, through the parietes of the abdomen. In man, it ascends and descends a little during expiration and inspiration; wherefore, when we wish to examine it by the touch, we should request the patient to make a deep inspiration. In the fœtus and in childhood, it extends more or less beyond the false ribs; in the adult, on the contrary, when free from disease, it is completely sheltered by these bones, with the exception of its epigastric portion; in the dead subject, and in the horizontal posture, the liver sometimes ascends an inch or two; but in the erect position, it descends so as to project beyond the margin of the ribs. During life, all the viscera being supported by the tonic action of the muscles, this mobility is much less; therefore the succussion which is communicated to the liver in the dead body, by falls, etc., is much greater than would be produced by the same causes acting upon the living subject: so that we cannot form a correct estimate of the situation of the one from that of the other. As the convex surface of the organ which secretes the bile is, as it were, encased by the diaphragm, and as the surfaces of both are mantled by the peritoneum, adhesions may readily take place between them; whence, we may easily conceive that abscesses of the superior part of the liver may point between the inferior intercostal spaces of the right side, beneath the margin of the

ribs, in the lumbar regions, flanks, or even in the epigastrium ; and, in all these cases, open externally, granulate, and sometimes heal. If, however, the abscess is more remote from the circumference of the liver, it will no longer burst externally, but will penetrate into the thoracic cavity itself, in which case one of two consequences will happen : either the inflammation which has occasioned the adhesion of the liver to the diaphragm has produced the same effect between the latter and the lung, or the respiratory organ is still floating and does not participate in the disease : in the first case the abscess will be evacuated by the bronchi, and will cause immediate death from suffocation ; or, if the collection is small, and is discharged gradually, it is possible for the patient to survive and finally even recover : this is a rare occurrence however. In the second, extravasation will take place into the chest, and the disease will become an empyema.

These collections (*foyers*) are of two species, and are not attended with equal danger : in one the extravasation takes place between the two serous surfaces, in the same manner that those circumscribed purulent collections are produced which we occasionally observe between the pleura pulmonalis and costalis. It is in this species that the matter seeks, as it were, every possible means to escape externally ; and, as the liver may still preserve its natural state, if the abscess is not very vast, and the adhesions which surround it are solid, its discharge may be followed by a complete cure. The other is situated in the tissue, even deep in the parenchyma of the organ. The existence of this last species has recently been almost denied ; but this is evidently going too far ; it is, in fact, certain that we have seen and dissected, upwards of twenty times, with the greatest possible care, purulent abscesses which had formed deep in the substance of the liver. We have seen them in the Hospital at Tours, consequent upon wounds of the head and protracted intermittents ; at the Hospital of St. Louis in Paris, in consequence of falls and different diseases ; and at the Hospital of la Faculté, in subjects who had undergone amputations, and in others who have died with erysipelas, ulcers of the legs, etc. This species may also be evacuated through the chest and by the same points as the preceding ; but this very seldom happens, and it is generally fatal. As to the cause of those hepatic abscesses which manifest themselves after

wounds of the head, it is difficult to find it in the relative disposition of the organ with those which surround it. Therefore, the opinion of Bertrandi has long since been rejected; who supposed that, as there is an additional quantity of blood distributed to the superior parts of the body, in these cases, the descending vena cava will have to support a more considerable column, and will consequently repel the same fluid, carried by the ascending cava, upon the liver through which it passes. So with that of Pouteau who, on the contrary, thought that the cerebral inflammation opposed the passage of the blood through the brain, and caused it to flow back into the descending aorta in general, and into the hepatic artery in particular. That of Chopart, of Desault, of Callisen, and of M. Richerand, who think that the concussion which the liver receives from the fall is the cause of these abscesses, is applicable to particular cases only, and therefore cannot serve for a general explanation. For example, a man wounds his head by striking it against a chimney; another cuts his great toe, and both die with purulent abscesses in the liver. Assuredly there was neither succussion, nor jarring of the hepatic organ in these cases. Lastly, the relations of structure which exist between one of the envelopes of the liver and the dura mater, and upon which M. Larrey has founded his theory, do not afford a more satisfactory solution of this phenomenon; it is sympathetic influence alone then, to which Desault had sometimes recourse, that must assist us in solving the most of these difficulties. But it is evident that this sympathy is here a mere word, which explains nothing, and we might as well confess our ignorance. Be this as it may, the relations of the concave surface of the liver are such as to facilitate the opening of these abscesses, when they approximate its anterior margin, into the transverse arch of the colon, through which their contents pass off by stool; or into the stomach, and are rejected by vomiting; or again, into the first portion of the duodenum, and discharged upwards and downwards. Posteriorly, the liver presents a gutter through which the vena cava passes; and the Lobulus *Spigelii* is situated directly between this vein and the œsophagus, so that it may be compressed by this lobe, when it is engorged or swollen in any manner whatsoever; and since, in almost all chronic diseases of the liver, with enlargement of this organ, a dropsy is formed, we are

induced to believe, with Doct. Bouillaud, that ascites frequently depends upon an obstruction of the venous circulation. With respect to wounds of the hepatic organ, they are extremely dangerous; in the first place, on account of the size and number of the vessels which ramify in and pass through it; in the second, because these wounds are necessarily penetrating. The fundus of the *gall bladder* corresponds to the cartilage of the ninth rib; so that, when this cyst is distended with bile, it will become prominent at this point. We may therefore conceive how dangerous it would be to mistake a similar tumour for an abscess. It also happens that, whilst in this state, it inflames and contracts such intimate adhesions with the paries of the abdomen which corresponds to it, that if it should be opened, extravasation will not take place into the cavity of the belly. It is well known that J. L. Petit was aware of this, when he recommended the extraction of Biliary Calculi by making an opening at the lower part of the hypochondrium; but, notwithstanding the successful cases related by this dexterous surgeon, his example has not been imitated. It should be observed that there are some lymphatic glands situated in the gastro-hepatic omentum and surrounding the biliary ducts; should these glands become enlarged, they will interrupt the free passage of the bile into the duodenum, and thereby occasion a general icterus, or, if the pressure is exercised upon the ductus choledochus, produce considerable distension of the gall-bladder.

(*b*) The *Spleen*, in the natural state, is situated almost entirely in the posterior part of the left hypochondrium: its smooth and convex surface corresponds to the three inferior intercostal spaces, and usually extends a little beyond the last rib; posteriorly, it is separated from the diaphragm above and the kidney below by the peritoneum only. When the stomach is distended with food it covers this organ, anteriorly; whence it follows that being more or less compressed by this viscus, after the repast, if we then take much exercise, as running, for example, the spleen being prevented from expanding freely, pain in the left side ensues, which soon obliges us to become tranquil. The spleen being essentially composed of vessels, it is more capable of bearing tumefaction than any other organ, and, although it is enveloped by a fibrous capsule, it is susceptible of acquiring an enormous

magnitude, so that it has been known to weigh as much as thirty five pounds; and we ourselves have seen it entirely filling the left half of the belly, descending even into the iliac fossa. Intermittent fevers in particular very frequently occasion a sudden developement of the spleen. From what has been said, it is important when we explore the abdomen for the purpose of detecting a tumour in this cavity, or when we wish to perform paracentesis on this side, that we should attentively examine this organ, in order that we may not refer to other organs a tumefaction appertaining to this alone, and that we may introduce the trocar at some other point, if the tumefaction is so great as to endanger its being wounded. Its wounds, however, are serious only on account of the hæmorrhage they may give rise to.

(c) *The Stomach.* This organ fills in part the left hypochondrium and a great portion of the epigastrium; but it is far from being fixed in its position. In the adult, its superior border is very much curved: but in the fœtus, it descends almost perpendicularly towards the umbilicus. In the state of plenitude, its anterior face is in contact with the inferior surface of the liver, and especially with the left lobe of this organ; which explains why the recumbent posture, on the left side, is so very distressing immediately after our meals, since the mobility of the liver permits it to gravitate in this direction. We may also comprehend, from these relations, how it is, that when the anterior paries of the stomach is destroyed by ulceration, this organ may to a certain extent continue its functions, without the aliments becoming extravasated into the bag of the peritoneum. It is during this state of plenitude also that the stomach may insinuate itself into the fissures of the linea alba, and that its mobility may permit it to extend even to the umbilicus, so that it sometimes forms a part of the contents of an umbilical hernia. As this organ retires into the hypochondrium after digestion, it is then less exposed to the action of foreign bodies, and a sword, for example, might be thrust through the epigastric region, from one side to the other, without touching this viscus. This was the case in Voussard, who died on the 7th October, 1825, at the hospital of *la Faculté*. In this man, a sword had traversed the belly by entering three inches above and to the left of the umbilicus, coming out on the right side between the ninth and tenth ribs, anterior to their an-

gle; the instrument had left the stomach and transverse colon below and on the left side, without touching them, by grazing the inferior surface of the liver, and then passed through this organ, above the gall bladder, after having perforated the lesser omentum. Posteriorly, the stomach rests upon the spleen and pancreas; when it becomes affected with cancerous or other deep ulcerations on this side, it habitually contracts adhesions with these organs, or with the peritoneal lamina which invests the posterior surface of the great bag of the omentum, so that its perforation may exist without causing effusion. These cancerous affections of the stomach may be arranged in three classes, relatively to the symptoms attendant upon them: 1st, Those which attack its cardiac orifice, in which case it is with great difficulty that the aliment reaches the cavity of the stomach, so that it is generally rejected in its undigested state; 2d, Those which affect a point intermediate to the two extremities of this viscus; then the scirrhus may exist a long time without producing vomiting, and thus remain for years without being detected; 3d, Those in which the pylorus is disorganized; then, as the rest of the organ is sound, the food readily passes into the stomach and undergoes chymification; but as the alimentary paste cannot enter the duodenum it is rejected by the mouth, and the vomiting generally recurs after meals at regular intervals.* In the latter case, it also frequently happens that the right extremity of the stomach becomes adherent to the concave surface of the liver, and blends itself with the biliary ducts, so that the scirrhus pylorus thus produces jaundice. When this disease exists, and when the tumour is of a certain volume, we may, by making pressure between the margin of the right false ribs and the umbilicus, generally feel it through the parietes of the abdomen; for the pylorus is on the right of the spine, between the liver and the transverse colon.

The great curvature of the stomach is embraced by the arch which results from the union of the two gastro-epiploic arteries; so that, in a certain relative position of this curvature with the parietes of the belly, and in emaciated individuals, pulsations may be felt, which have sometimes been mistaken for aneurisms, or have been described, under other circumstances, as nervous phe-

* Colles, *op. citata*.

nomena; besides, this arterial arch will render wounds of the stomach more dangerous on this side, on account of hæmorrhage. Two arteries also run along the small curvature of the stomach, the coronaria ventriculi and the pyloric artery; but this vascular loop being very deeply situated it can seldom be wounded. With respect to wounds of the anterior part of the stomach, they are both more frequent and less dangerous, because it has fewer vessels, and sutures might be applied to it with greater facility.

(*d*) The *Duodenum* is important in surgery both on account of its fixed position, which prevents it from entering into the formation of herniæ, and its relations with the other organs of the region which it occupies. Thus its first portion approximates so near to the gall-bladder and concave surface of the liver, anteriorly and superiorly, that, when diseased, it may compress the biliary ducts, or that abscesses of the liver, and calculi of its receptacle, may make their way into it; and it is more than probable that most of the large biliary concretions which pass off with the fœces have entered into the alimentary canal in this manner, rather than through the natural channels, which are actually too small to admit them. The second portion, resting upon the kidney, may also be perforated by abscesses of this organ; so that renal calculi, purulent or urinary collections may sometimes be equally evacuated by this passage. Anteriorly, it corresponds to the colon, and passes under the commencement of its transverse arch, to which it frequently becomes agglutinated during inflammations; posteriorly, and on the left, it embraces the pancreas and covers its duct, as well as the termination of the ductus communis choledochus, which perforate its posterior paries; so that when deep seated disorganizations of this portion of the duodenum exist, the biliary excretion will be disordered. The third portion lies across the spine, between the laminæ of the transverse meso-colon, and rests upon the inferior vena cava and abdominal aorta, immediately below the superior mesenteric artery. Therefore, as the peritoneum is but loosely connected to the anterior surface of this intestine, it is capable of undergoing considerable dilatation, and thereby elevating the latter vessel to such a degree, that its pulsations may be felt through the paries of the abdomen. With respect to the pancreas itself, it equally crosses the vertebral column, and is situated before the

aorta, between the cœliac and the superior mesenteric arteries: so that, should it become enlarged from scirrhus induration, it may produce very firm compression upon the aorta, vena cava, and the cœliac arteries and even upon the superior mesenteric. This being the case, it is by no means suprising that this affection, by interrupting the return of the venous blood, should occasion œdema of the inferior extremities and even ascites, or, by opposing the free circulation into the parts below, give rise to very strong arterial pulsations in the epigastric region, pulsations which might lead us to suspect the existence of an aneurism of the principal arteries of the body, or of one of the three branches of the cœliac.

The *Intestinum Tenue* (*Small Intestine*) passes obliquely from the left side of the second lumbar vertebra into the right iliac fossa, where it opens into the cœcum; but, in passing through this space it makes a great number of turns, which constitute the intestinal circumvolutions. Taken as a whole, the small intestine represents a species of moveable bundle, which occupies the whole of the umbilical region, a portion of the flanks and of the hypogastrium; its weight tends to drag it towards the most dependent parts, and the length and extensibility of the mesentery permit it to escape through all the natural or accidental apertures of the abdominal parietes. Therefore, we generally find it in almost all inguinal, crural, perineal, umbilical and ventral herniæ, etc. It is this also which is suddenly protruded by the action of the muscles, whenever we make an opening of a certain extent into the belly, and which is most liable to be wounded during these operations. As it fills the most prominent part of the abdomen, it is also most frequently injured in penetrating wounds; and it may then be divided longitudinally, transversely, partially or completely. These wounds, always very dangerous, will be the more so the nearer they approximate to the duodenum: on the one hand, because if an accidental anus should be established, the aliments will escape before they have furnished all their nutrient particles to the economy; on the other, because, near the transverse meso-colon, the small intestine is so deeply situated that it would be difficult to bring the divided portion of it to the external wound, without giving rise to very serious consequences. With the view of curing these wounds, surgeons have, at all times, recommended the suture, and some-

times they have employed the glover's suture, at other times the interrupted, and again the suture with loops of Ledran ; but these means do not fully accomplish the desired object. The re-union is in reality only established by means of the adhesions of the lips of the intestinal division to the lips of the external wound ; and hence incessant colics after the cure, when it is effected : also, occasionally extravasation into the peritoneum takes place. The difficulties, in these cases, may generally be attributed to the suture, such as is usually advised, bringing into contact either the mucous membrane with itself, or two membranes of a different nature. Now, since the time of Bichat, all surgeons are aware that two laminæ appertaining to two different systems agglutinate with difficulty, and that the mucous tissue very seldom contracts the adhesive inflammation. Consequently, it will be preferable, in the partial divisions of the small intestine, to adopt the plan which Mr. Joubert has invented, called "*invagination*"; and which consists in folding the lips of the wounded intestine inwards previous to passing the threads through them, in order that after the suture is made the two serous surfaces may be drawn into contact with one another. But we will resume the consideration of these lesions of the digestive tube when we examine inguinal herniæ and the anatomy of the artificial anus ; and will merely observe here, that, as the concave border of this canal receives all the vessels, its wounds must necessarily be more serious than those of its convex portion, which is besides more readily brought in apposition with the parietes of the abdomen ; that, being composed of circular and longitudinal fibres, its divisions will necessarily be followed by retraction, whether they are parallel or transverse to the axis of the intestine. As the serous tunic is intimately adherent with the muscular, it follows that this portion of the alimentary canal is scarcely susceptible of dilatation ; and as the fleshy membrane is composed of fibres which regularly intersect each other, it also follows that it opposes great resistance to distending causes, and that the vermicular movements are executed with great regularity. The villous tunic is the most important in all respects, especially in relation to the functions and to the internal pathology. Although it does not enter into our plan to treat of these matters, we will nevertheless observe that this tunic contains a great number of glandular granules.

already well described by Peyer, whose name they bear, and by Haller; described also by Brunner in the stomach and duodenum;—glands or follicles which are disseminated, on the one hand, throughout the whole extent of the membrane, and, on the other, collected in oval, round, or irregular patches, especially in the vicinity of the cæcum. From 1816 to 1820 we have minutely investigated, with Dr. Bretonneau, (who has been engaged in this study since 1812,) the changes which these organs undergo in acute and chronic diseases, upon a very great number of subjects, and, together with him, have ascertained satisfactorily that their specific inflammation, an inflammation which represents to a certain point the variolous eruption in the intestines, is the cause of the great majority of putrid, adynamic or ataxic fevers, or of the gastro-entérite of modern times. In 1820 and 1821 we had several conversations with M. L'Herminier, a respectable practitioner, upon this subject; and, since that time, this opinion has spread, but in an indefinite manner, among the physicians of the capital. The same organs are also the seat of the ulcerations which we so often find in the last stage of phthisis. But this subject will soon be exposed by M. Bretonneau himself, in a work which must have great influence upon medical opinions.

(*f*) The *Cæcum*, in the adult, fills almost the whole of the right iliac fossa: the extremity of its appendix, which then floats in the pelvis minor, is liable to become agglutinated to the neighbouring parts, thereby forming a ring into which the *intestinum tenue* may insinuate itself; so that an internal strangulation might result, which would be so much the more dangerous in consequence of its being almost impossible to detect the cause of it with certainty during life. This is not the only strangulation to which the small intestines are exposed without escaping from the abdomen. They may become entangled with each other, and produce the same accident; sometimes they have one or more diverticula which may likewise become twisted, contract adhesions, and occasion the same effect as the appendix of the cæcum. A remarkable example of this kind is related by M. Rayer.* At other times an accidental membranous band may be formed, and gird the intestines, as was observed upon the body of Chopart; or a cicular adhesion of the epiploon with the other organs;

* Archives, générales de Médecine, Mai, 1825.

finally, a laceration of the latter membrane may take place and thereby become another cause of strangulation.* All these strangulations have for a long time been confounded under the name of *volvulus* or *ileus*, and surgeons generally attributed the symptoms experienced by their patients to the intus-susception, (*invagination*), to which their attention was chiefly directed previous to the present day. If it was possible to ascertain the nature of the disease in these cases, and especially its precise situation, *gastrotomy*, advised by Barbette, performed successfully under the inspection of Nuck, and ineffectually attempted by M. Dupuytren, might, we have no doubt, save some victims.

The manner in which the cœcum is fixed to the iliac fossa is not always the same: thus, it is sometimes surrounded by the peritoneum in such a manner, that this membrane forms for it, posteriorly, a meso-cœcum, which renders it very moveable and capable of being displaced with the greatest facility; at other times, the serous membrane covers its two anterior thirds only, in which case it seems solidly fixed in the point which it habitually occupies. In the first case, we conceive that it might pass freely towards the inguinal or crural canals, through a rent in the *linea alba*, the umbilicus, perinæum, and even pass to the opposite side, of which there have been examples, and form herniæ similar in every respect to those produced by the escape of the small intestines, since the cœcum is then completely enveloped by the peritoneum. In the second case, this intestine may likewise escape through the openings just enumerated, but with less facility; but at this time its portion, which is covered by cellular tissue only, may be found in contact with the hernial sac, and may even be drawn into the inguinal canal by pedunculated adipose corpuscles, without any peritoneal bag existing before the displaced cœcum. We need not mention that such a species of hernia would require the greatest caution during the operation. As this intestine is sacculated, large, and in the form of a *cul-de-sac*, it happens that, in the constipation so frequent in aged and pregnant women especially, indurated fæces accumulate in it, and form a tumour in the right iliac fossa, which we must carefully avoid confounding with a pathological alteration.

(g) The *Ascending Colon*, which is only the continuation of

* Voyez Sabatier, Med. Opérat., tom. 3, article *Hern.*

the cœcum, ascends as high as the supra-umbilical line, before it turns to the left in order to form the transverse colon; less voluminous than the cœcum, sacculated in the same manner, and of a much greater calibre than the small intestine, it is also sometimes fixed by a complete meso-colon before the quadratus lumborum muscle and the kidney; and, at other times, the peritoneum, covering only four fifths of its circumference, leaves its posterior fifth applied directly upon these organs: whence it follows that lumbar abscesses and nephritic calculi may penetrate into this intestine and be evacuated by stool, and that, reciprocally, a perforation of the colon may be followed by a stercoraceous deposition in the lumbar region, and thus produce a complete intestinal fistula. It is true that the same thing may occur in the anterior half of the cœcum; that is to say, that adhesions may unite it so intimately to the anterior paries of the iliac cavity, that if the intestine should become perforated by ulceration, an abscess and subsequently a stercoraceous fistula will be formed in the iliac region, above Poupart's ligament; posteriorly, however, this is impossible, because it rests indirectly upon the os ilii. It is also, as we have seen, in consequence of this disposition of the colon, that it has been proposed to search for this intestine by the lumbar region, either with the view of establishing an artificial anus, in cases of imperforate rectum, or for the purpose of extracting foreign bodies from it. To its anterior part a certain number of adipose epiploic appendages are attached, which may become very large, and especially much elongated; so that, in the first case, they may draw it into the natural or accidental apertures of the abdomen, and thus cause it to enter into the composition of herniæ; in the second, should inflammation of the peritoneum ensue, they will frequently unite in such a manner as to form loops, or bands, through which the small intestine or a part of some other organ may pass, and thus give rise to internal strangulation. It may also be stated that if these appendages are found in a hernial sac, they will be sufficient evidence that the tumour includes a portion of large intestine. Finally, if the right colon has been [partially] destroyed by gangrene, in a hernia, or divided by a cutting instrument in any manner whatsoever, the flaccidity of its parietes, its dimensions, and the indisposition of its fibres to retract, will permit us to attempt its invagination more easily, or to employ the different

forms of suture. Its villous tunic, like that of the small intestine, contains some follicles of Peyer or Brunner, but with this remarkable difference, that they are larger and more disseminated, not a single cluster being observable upon it.

(*h*) The *Transverse Colon*, or *Arch of the Colon* is only the preceding intestine which has changed its direction ; its volume, however, is a little less towards its left extremity and it also differs from it by possessing greater mobility and in its anatomical relations ; otherwise it presents the same characters. In consequence of the extent of its meso-colon, it may descend even into the cavity of the pelvis, and thereby be drawn by the omentum into herniæ of the groin ; it may also ascend towards the diaphragm, and pass into the cavity of the thorax through a perforation or laceration of this muscle ; and as it is attached, by means of the anterior sheet of the great epiploon, to the larger curvature of the stomach, it necessarily accompanies this organ in all its changes of position : on the right, its convex surface is so close to the gall-bladder and concave fossa of the liver, that it may contract adhesions with these organs during inflammations. When this intestine is distended with flatus, its sacculi may be occasionally distinguished from the surface. From its relations with the omenta, and the great length of its meso-colon, this transverse portion of the large intestine is more frequently found in herniæ than either of the others, and has been met with in inguinal, crural, perineal ruptures, etc. ; but it is particularly in umbilical and epigastric herniæ that the arch of the colon enters as a constituent organ, because forming a loop in relation to the supra-umbilical line, it is well calculated to escape through all the openings which may exist in the vicinity of the umbilicus and epigastrium. As it is in contact with the anterior wall of the abdomen, it may readily become agglutinated to it when in a state of ulceration ; and in this way stercoraceous fistulæ, in the upper part of the umbilical region, may be the result of its perforation ; and, if these adhesions are well established, even abscesses developed in the peritoneal cellular tissue might open into this intestine.

(*i*) The *descending Colon* seems to be much deeper-seated than the right ; in the first place, because it is of much smaller calibre : secondly, because it dips much deeper into the hypo-

chondrium, and lastly, because the peritoneum very seldom forms a distinct meso-colic duplicature of a certain length, in order to attach it to the anterior part of the lumbar region. From these differences it results, 1st, that it is much less exposed to injury from without; 2d, that it is seldom displaced and but very rarely found in herniæ; and 3d, that it might be more easy to reach it from the lumbar region without opening the peritoneum, since in the first place, it scarcely ever possesses a meso-colon, and in the second, because the kidney of this side does not descend quite so low as on the other. There is also another reason why surgeons, if they were desirous of imitating Callisen and some others, should prefer it for the purpose of establishing an artificial anus: it is because the fœces when they arrive at this portion of the digestive tube, no longer contain materials proper for nutrition (*materiaux alibiles*); so that this infirmity at least would not impair digestion; whereas, on the other side, and especially in cases where the small intestine should serve to give vent to the excrement, emaciation and even marasmus would be consequent upon the establishment of a similar aperture. Inferiorly, the left colon becomes flexuous, and is curved in the form of the letter S upon the iliac fossa; then, in consequence of the considerable elongation of the meso-colon in this place, it becomes very moveable, and loses the most of those characters which appertain to its middle portion: whence it follows that it very frequently insinuates itself into the corresponding inguinal and crural apertures, in order to produce herniæ; it may even pass to the right side, in the same manner that the cœcum sometimes passes to the left. Like the latter intestine also, and still more frequently, the sigmoid flexure of the colon becomes distended with fecal matters from constipation, and especially during pregnancy; so that sometimes this portion of the bowels forms an undulated or tuberculated tumour which fills the whole iliac fossa, and should the external membrane of this intestine become inflamed, while in this state, it will unite to the parietes of the abdomen and give rise to a stercoral abscess in the left iliac region, in the same manner that the cœcum may produce it on the right. Superiorly, this intestine rests upon the spleen, then upon the kidney; anteriorly, it has but very few appendices epiploicæ; its external surface becomes more regular and less sacculated the nearer

we approximate its inferior part; which is owing to the three bands of fleshy fibres, which exist completely isolated in the other two portions of the large intestines, expanding gradually in the descending colon, so that the circular fibres are scarcely perceptible when it arrives at the sigmoid flexure. This difference will necessarily occasion one also in the retraction of the lips of wounds made at different points of this canal; thus, where the *sacculæ* exist, it is evident that the edges of a transverse incision between two *bandelets* will have but a slight disposition to separate, and that, in a longitudinal wound, the contrary will take place; whereas in approaching the rectum, these phenomena will be reversed. It is very uncommon to meet with *diverticula* upon the large intestine. F. Meckel even thinks, according to the theory which he has promulgated respecting these anomalies, that they never do occur in this situation. Notwithstanding, we found during the present year, in a man who died from apoplexy, the cæcum and the three portions of the colon covered with small prolongations in the form of *culs-de-sac*, being two, three, four, and even six lines in length and capable of containing a lentile, a pea, the extremity of the finger, etc.; these loculi opened into the intestine by an orifice much narrower than their fundus, and were all filled with clods of very hard fœcal matters; they were formed by the peritoneum a little thickened, and by the mucous membrane, which seemed to have escaped through the separated fibres of the muscular tunic. This specimen was, at the time, shewn by Bécclard to the students attending his lectures, and M. Bougon submitted it to the examination of the Royal Academy of Surgery.* One would suppose that a disposition of this kind would favour greatly the production of ulcers, partial inflammations and perforations.

We now see that the large intestine, from the cæcum to the commencement of the rectum, presents a very extensive arch, the two extremities of which, very closely approximated, are found external to the sacro-vertebral angle, upon the sacro-iliac symphysis, whilst its expanded portion, represented by the transverse colon, corresponds to the superior limits of the umbilical region. It is in this great circle that the bundle of the small intestines is lodged, as well as their principal vessels.

* According to the celebrated Professor at Halle, these would only be considered false diverticula.

(*j*) The *Mesentery* and *Meso-colons*. The first of these duplicatures is the most important of all, and, like the canal which it serves to fix, extends before the spine from the second lumbar vertebra to the right iliac fossa; it is thick at first, and encloses between its laminæ the aorta and vena cava, but superiorly only; afterwards we find in it a very great number of lymphatic glands, all the arteries given off by the concavity of the superior mesenteric, and which constitute in this duplicature a very rich net-work, which is ultimately lost in the concave margin of the small intestines. All the veins which enter into the formation of the great mesaraic (*Superior Mesenteric*) are equally included in it; so that wounds of the mesentery are dangerous, particularly on account of the hæmorrhage which must result from them. Besides glands, this double lamina of the peritoneum also includes numerous lymphatic vessels, and almost all the lacteals; and, as almost all the inferior half of the lymphatic system must, in its way to the thoracic duct, traverse the posterior portion of the mesentery, it thence follows that the glands situated within it very frequently become enlarged; especially as these glands also tumefy in consequence of several intestinal inflammations. In *tabes mesenterica* these organs sometimes form a very considerable mass, and in persons afflicted with cancer of the testicles or indeed of the neck of the uterus, it is not unusual to find them of a large volume. In all these cases, the alimentary canal is pushed forwards, or towards the sides, so that the tumours may be easily felt through the walls of the abdomen. We must not, however, mistake the projection of the spinal column, in emaciated subjects, for enlargements of this nature.

Finally, the mesenteric duplicature leaves before the spine a separation, which is filled by cellular tissue, the aorta, vena cava, and glands, and circumscribes a space which is somewhat similar to that which exists behind the mediastinum in the thorax; it permits the intestines to float and to incline from one point of the abdominal cavity to another. This mobility of the intestines has given rise to the apprehension of wounding them in performing the operation of paracentesis abdominis, and hence the numerous cautions to avoid thrusting in the trocar too deeply. It seems to us, however, that there is very little reason for these apprehensions, and that the instrument may always be passed to

the depth of several inches, at one thrust, without danger of wounding the intestinal canal, and, still less, the arteries of the mesentery, as is stated to have occurred in some cases. In fact, we never perform this operation, in ascites, until the abdomen is greatly distended by the fluid: now, when this is the case, the intestines are repelled into the lumbar gutters, and are far from floating in the liquid. Even should they tend to remove from the vertebral column, as the abdominal parietes are then more than a foot distant from the spine, and as the mesentery is only five or six inches in extent, there will always be a considerable space between the alimentary canal and the point of the belly which the instrument traverses: so that these wounds, so much dreaded, are, in fact, physically impossible, unless we plunge in the trocar out of all reason, or introduce it too near the loins, the iliac fossæ, or the supra-umbilical line.

Of the *Meso-colons*, the transverse is the only one which we will attend to at present. It actually divides the interior of the abdomen into two cavities; one inferior, which is filled by the small intestines; the other superior, which contains the stomach, spleen and liver. In its posterior border we find the inferior portion of the duodenum, the superior mesenteric artery and the colic branches which it gives off. It would be important to recollect that a large arterial arch extends along its convex margin, or rather along the whole of the concave border of the colon, if in herniæ we were obliged to remove a portion of this canal, in order to attempt its invagination.

(*k*) The *Epiploons*. The *gastro-hepatic* extends from the concave surface of the liver, and principally from the horizontal fissure of this organ to the small curvature of the stomach; it encloses the hepatic artery, vena porta, some lymphatic glands, and, in its right border, the biliary ducts, below which is found the foramen (*hiatus*) of Winslow, or the opening of the great bag (*posterior cavity*) of the omenta, the anterior paries of which is formed partly by that under consideration, next by the posterior surface of the stomach, and lastly by the epiploic portion which extends from the great curvature of the latter organ to the convex border of the arch of the colon. In this cavity we likewise observe the lobulus *Spigelii*, vena cava, aorta, cœliac trunk, pancreas, etc. Lastly, it is bounded, inferiorly, by the

transverse meso-colon ; and, as its aperture between the biliary ducts, vena cava, colon and the liver, is easily obliterated in consequence of inflammation of the peritoneum which surrounds it, it thence follows that this pouch may become the seat of an encysted dropsy, several examples of which have been recorded.

The *Great Epiploon*, or *Gastro-colic omentum*, fixed by one of its double sheets upon the great curvature of the stomach, and by the other upon the convex border of the transverse colon, is spread out like a curtain over the whole anterior part of the small intestines ; so that the latter can scarcely protrude at the umbilicus and other apertures of the linea alba, without driving before them this quadruple serous membrane : therefore, these kinds of herniæ are almost always epiploic at the same time that they are intestinal. In consequence of its superior attachments, epiploceles in general and those of the groin or perineum in particular, are generally productive of colicky pains, and sometimes an inclination to vomit. This web, although fine, envelopes arteries of considerable magnitude, which render the removal of a portion of it, in herniæ, somewhat dangerous, unless they have been previously secured by ligature. But, on the other hand, we perceive, from the observations of Arnaud, and J. L. Petit, that the ligature of this membrane in mass was generally followed with alarming symptoms : therefore, each artery should be tied separately, or the omentum should be retained in the wound. In peritonitis which has terminated successfully, it may contract adhesions, which becoming elongated will produce membranous bridles capable of occasioning symptoms of strangulation, if the intestines should insinuate themselves between these bands and the parts to which they are glued ; or it may form a pouch with the anterior wall of the abdomen, in which pus may collect, constituting an abscess, perhaps susceptible of cure, if it should open externally. If, on the contrary, serosity simply should accumulate in this accidental cavity, a species of encysted dropsy would be the consequence. Should the omentum become partially united to the surface of the intestines, it will interfere with their peristaltic movement, and more or less acute pains will be the consequence of it ; divers small pouches might also result from it, and each of them will become filled with a serous or purulent fluid, and give rise to cysts more or less numerous. Fi-

nally, it must be noted that the epiploon is much more extensive on the left than on the right, and it is principally for this reason that we prefer performing the operation of paracentesis abdominis on the right side, notwithstanding the liver generally descends lower than the spleen.

At birth, the disposition of these viscera is so different from that which exists in the adult, that we may draw from it some particular observations. Thus, the cœcum and its appendix being more approximated to the umbilicus, are as completely enveloped by the peritoneum as the small intestines, and are consequently far from being solidly fixed in the iliac fossa: whence it follows that they may be displaced more easily and form herniæ. The small intestine itself is lower and naturally pushed to the right by the transverse and descending colons, which are slightly inclined to the left. Does not this circumstance tend to render inguinal and crural herniæ more frequent on the right side than on the left? and, in the child as in the adult, is not this frequency also favoured by the obliquity of the mesentery? The stomach being less curved, and the pylorus nearer the umbilicus, occasion the great epiploon, which, moreover, is but slightly developed at this age, to be much more frequently met with on the left, and consequently epiploceles will be more frequent on this side than on the right. The spleen descends below the false ribs; and the liver, which fills the whole of the right hypochondrium, a great part of the epigastrium and the superior and right portion of the umbilical region, gives to the belly that disproportionate volume which it then presents; the protuberance which it forms anteriorly also depends upon the slight developement of the lumbar gutters, whereby those viscera which they afterwards receive are now pressed before the spinal column; but especially, as we already have had occasion to mention, upon the very moderate capacity of the fœtal pelvis, which obliges all the organs to be contained in the cavity of the abdomen properly so called. This enormous magnitude of the abdomen has not, in our opinion, sufficiently engaged the attention, relatively to delivery in foot presentations: in fact, when the head is propelled first, the rest of the body in general and the abdomen in particular pass through the uterine neck, already dilated by a larger bulk, promptly and without difficulty. But if, on the contrary,

the pelvic extremity presents, especially if the feet have come down before the complete dilatation is accomplished, the trunk enlarges in proportion as it descends, and the belly will thereby be compressed for a long time by the contractions of the womb and the resistance of its orifice. This compression, which operates particularly upon the liver, an organ easily lacerated, contused, and which the blood of the fœtus must traverse before it reaches the heart, must be a very powerful cause of the dangers which attend upon this presentation. The uterus and its appendages during pregnancy, and the bladder when distended by urine, are, as in the fœtus, situated above the brim of the pelvis, and may, under such circumstances, be injured by wounds penetrating the cavity of the abdomen.

In the different attitudes, the position of the organs contained in the belly changes also: when we stand erect, for example, the diaphragm and the augmented prominence of the vertebræ drive the viscera forwards and downwards, increasing the volume of the hypogastrium; in the horizontal posture, on the contrary, the intestines push up the diaphragm or recede into the vertebral gutters, and tend to remove from the iliac regions, if the pelvis is more elevated than the chest; or, in other words, the moveable parts within the abdomen submit to the laws of gravity. It is in the latter position, and on the back, that we must place our patients when we wish to ascertain the state of the parts through the abdominal parietes or perform any operation upon them. It is in this position that, the muscles being relaxed by the semi flexion of the thighs, legs and head, the walls of the abdomen are supple and easy to depress, and instead of being prominent they present a concavity anteriorly, which is of greater or less depth in emaciated subjects. The iliac region in particular is sometimes excavated in a very decided manner, so that by attentive examination we may readily feel, on the right, the sacculi (*bulgings*) of the cœcum, on the left the sigmoid flexure of the colon, and, on the inner side of each iliac fossa, the eminence formed by the psoæ muscles, and a little higher the sacro-vertebral angle: so that by pressing with the thumb obliquely from above downwards, and from within outwards, in the direction of a line drawn from the sides of the sacro-vertebral angle to the middle of the space which separates the anterior superior spine of the os ilium from

the symphysis pubis, the circulation might be suspended in the corresponding extremity.* This compression, in the track of the external or primitive iliac arteries, may be very useful in surgery, on the one hand, because there are subjects who support it better than that which is exercised upon the body of the pubis ; on the other, because there are pretty numerous circumstances in which we cannot apply it upon the latter part but with extreme difficulty, as, for example, in the disarticulation of the thigh, in the ligation of the femoral artery above the profunda, that of the external iliac artery, and lastly in cases wherein this artery is wounded.

The umbilical region is likewise so depressed that we may easily feel the spine, as well as the pulsations of the aorta, on its left side : so that it is possible to compress this large trunk in the same manner, above its bifurcation, in a case of urgency.

It must not be inferred, from what we have just said, that a space actually exists behind the abdominal parietes : on the contrary, they are always moulded upon the viscera, and the belly is, in reality, only a possible cavity. Notwithstanding this remark has been frequently made, it is not on that account the less important. It enables us to comprehend, in fact, how it is that fluids extravasated in the peritoneal cavity, in consequence of wounds, inflammations, etc., do not descend towards the most dependent points, during life, and why it is that they are found accumulated, sometimes in one point, sometimes in another, according to the situation of the disease or accident. Thus, in penetrating wounds, if some vessels of a certain magnitude are divided, the blood does not flow into the vertebral gutters or pelvis minor as we might at first imagine ; but is spread out in a layer, or forms for itself a cavity in the vicinity of the wounded organ ; and it is in this manner that those circumscribed cavities (*foyers*) are produced, to which Petit the younger, among the first, directed the attention of practitioners.

Moreover, the cause which prevents the formation of a vacuum in the abdomen is altogether physical and very simple : for the parietes of the abdomen being supple, flexible and composed of soft parts, the atmospheric pressure necessarily keeps them applied against the organs situated behind, and obliges them to

* Bogros, thèse 1823.

follow these organs in all their movements: so that these parietes being of a muscular nature, we may say that they actively compress the viscera, until from being curved and convex anteriorly they become straight from the sternum to the pubis, and that their depression, on the contrary, is altogether passive. If this point was admitted, it would be a very strong argument in favour of the physiologists who maintain that the stomach is not inert during the act of vomiting, and this question so long contradictorily argued by MM. Portal, Magendie, Maignault, J. Bourdon, Piedagnel, etc., would be easily determined. In fact, during the efforts of vomiting, the epigastrium becomes deeply excavated, the chest approximates the pelvis, and the stomach seems to call to its assistance the abdominal parietes in order to support it during its contractions; in this state the recti muscles tend to pass towards the diaphragm; they become very much incurvated, and as their contractions, on the contrary, tend to straighten their fibres, we must naturally conclude that they are then in a state of relaxation, and that, far from compressing the stomach, they only follow its contractions and are, if I may so say, dragged by it.

We may now examine succinctly the order of super-position of the organs in the three principal zones of the abdomen.

In the first place, in the *Epigastric Zone*, we find, 1st, on the right, a portion of the diaphragm and the whole of the great lobe of the liver; 2d, on the left, the whole of the great cul-de-sac of the stomach, and the spleen, situated posteriorly; 3d, in the middle, the cardia, the rest of the stomach, the small omentum, gall-bladder, and its ducts, the hepatic artery and coronary of the stomach, and the vena porta; 4th, more deeply, and always in the epigastrium properly called, the posterior cavity of the epiploons, the first portion of the duodenum, the ductus choledochus, the pancreatic duct and gland, the great mesaraic vein, the pyloric artery, the origin of the superior mesenteric artery, the splenic artery and vein, the cœliac trunk, the phrenic arteries and the small lobe of the liver; more deeply still, the semilunar ganglion, the solar, cœliac, hepatic, stomachic coronary, splenic, diaphragmatic and superior mesenteric plexus; the vena cava, aorta, crura of the diaphragm, and the bodies of the first two lumbar vertebræ; laterally, the emulgent vessels, the superior half of the kidney.

the renal capsules, renal plexus, an abundant cellular tissue, the origin of the psoæ muscles, the ligamentum arcuatum, and the posterior and lateral parts of the diaphragm. It is, consequently, in a space circumscribed by the lesser curvature of the stomach, the inferior surface of the liver, the foramen (*hiatus*) of Winslow, and the biliary ducts, behind the lesser omentum, that the lobulus *Spigelii* is situated, having, on its right, the vena cava, on its left, the cardia and the aorta, anteriorly, the sinus of the vena porta, posteriorly, the semi-lunar ganglion; all of which organs may be compressed by it, when it is considerably enlarged; in this space we also meet with the continuation of the aorta and of the vena cava, the solar and cœliac plexus, and the cœliac artery: so that, under all relations, wounds of the epigastric centre must be extremely dangerous, and very sudden and somewhat forcible compression at this point immediately produces a dull, deep and suffocating pain which is immediately followed by syncope in some individuals.

In the *Umbilical Zone*, we find, 1st, the great omentum and transverse colon, superiorly; 2d, laterally, the right and left portions of the same intestine; 3d, in the middle, the circumvolutions of the small intestine; 4th, upon another plane, superiorly, the transverse mesocolon, including the arterial arcades derived from the convexity of the superior mesenteric artery, the trunk even of this artery, the last two portions of the duodenum; 5th, in the median part, the mesentery, presenting all the arterial, venous, and lymphatic vessels, as well as the numerous glands of the small intestines; 6th, externally, the inferior portion of the kidneys, the ascending and descending meso-colic duplicatures, when they exist, the ureters and the spermatic vessels; 7th, deeply, the aorta, vena cava, the origin of the thoracic duct, the lumbar arteries, the inferior mesenteric; finally, the continuation of the psoæ muscles and the last three lumbar vertebræ.

In the *Hypogastric Zone* we meet with, 1st, in the middle, the epiploon and intestinum tenue; 2d, the sacro-lumbar angle, upon which the origin of the primitive iliac vessels and the arteria sacra media rest; 3d, upon the sides, the iliac cavities, of a triangular form, the parietes of which approximate or diverge, according to the attitude, according to the elevation or depression of the diaphragm or, again, according to the quantity of intestines

contained within them; 4th, on the right of these cavities, the cœcum; on the left, the iliac S of the colon; 5th, the peritoneum; 6th, the fascia propria; 7th, the ureter enveloped by this fascia, and crossing the iliac vessels at the anterior part of the sacro-iliac symphysis; 8th, the vas deferens, passing from the inguinal opening of the fascia transversalis into the cavity of the pelvis and crossing the external iliac artery an inch behind the crural ring; 9th, the spermatic vessels upon the anterior face of the psoæ muscles; 10th, the genito-crural nerve running by the side of the iliac vessels; 11th, the iliac vessels, situated on the inner side of the psoæ muscles: 12th, the origin of the epigastric and circumflex iliac arteries, opposite to the posterior border of the os pubis; 13th, the fascia iliaca; 14th, a supple cellular layer enclosing the inguino-cutaneous nerve; 15th, the iliac muscle externally; 16th, the psoæ internally; 17th, the crural nerve, between the latter and the preceding; 18th, quite externally, the circumflex iliac artery; 19th and lastly, deep seated, some branches of the ilio-lumbar vessels, some cellular tissue also, and the iliac portion of the os ilium.



CHAPTER IV.

OF THE PELVIS.

This part of the body terminating the trunk inferiorly, we should not perhaps separate it from the head of the femur and from the soft parts which surround it, for the purpose of studying it conveniently by regions; but the coxo-femoral articulation and the fold of the groin are evidently too much incorporated with the inferior extremity to permit us to detach them from it. In examining the pelvis we will first consider the containing and afterwards the contained parts, in the same manner as was observed in treating of the abdomen; or rather we will study it successively in its exterior and in its interior.

ART. I. EXTERIOR OF THE PELVIS.

In this division we will examine the anterior and middle portion of the pelvis ; but its anterior and lateral parts will be included in the extremities : its posterior half will be divided into a median posterior region, and lateral posterior regions : lastly, we will also find in it an inferior or ano-perineal portion.

Sect. 1. *The Pubic or Anterior Region.*

This region will comprise the symphysis of the pubes and all the soft parts which it supports, or which cover it, and in such a manner as to include in man the external sexual organs. It is continuous superiorly with the hypogastric region ; inferiorly, it is bounded by a transverse line drawn from one pubic ramus to the other behind and below the scrotum, or the parts which correspond to it in the female ; laterally, by two other lines which would be dropped from the spine of the pubis upon the extremities of the preceding line.

In man, the pubic region, which might as well be called the external genital region, is composed of three distinct parts, viz : the pecten, the scrotum, and penis.

A. *The Pecten (Pénil).*

This portion is, so to say, the only one which exists in the female, where it is known by the name of *mons Veneris* ; to this, however, we must add the clitoris, which, in this sex, is also included in the pubic region. It is most prominent in the fœtus and in childhood, and generally a little more so in man than in the well proportioned woman ; and in the latter it is sometimes separated from the hypogastrium by a groove of some depth, but which exists only in a small number of cases.

CONSTITUENT PARTS.

I. *The Skin.*

Remarkable for its thickness, the quantity of follicles it contains and the numerous hairs which cover it, the skin of this region is rugous, brown, unctuous, and readily bedewed with the sebaceous matter which is freely secreted from it, and hence, without doubt, the reason why the *pediculus pubis* is so frequently met with in uncleanly individuals; its texture is dense, compact and but slightly extensible, it is nevertheless susceptible of yielding to the distension occasioned by the slow and gradual developement of tumours situated between it and the bones, or in the depth of its follicles. M. Faneau-Delacour* has recently extirpated a tumour of this species which was as large as an adult head. As the skin of the pubis descends upon the labia and clitoris of the female, upon the penis and spermatic cord in the male, it becomes suddenly attenuated, and its extensibility is increased in proportion.

II. *The Subcutaneous Layer.*

This consists of an intricate intersection of fibrous filaments and cellulo-adipose lamellæ, forming a species of elastic cushion which somewhat resembles the sub-cutaneous fibro-cellular layer of the hand or fingers, excepting that it is less compact and becomes gradually rarefied as it proceeds from the centre towards its circumference, where it is continuous on all sides with the *fascia superficialis*: sometimes this layer is an inch and even more in thickness and seems intended to diminish the violence of the concussions to which the pubic eminence is subject. Its phlegmonous inflammations are generally very painful, and from its filamentous texture, the intimacy of its union with the skin and the fibrous tissue covering the bones, pus does not very readily accumulate in it in the form of abscess, but soon infiltrates into the labia or scrotum.

* *Précis de la Constitution Médicale du département d'Indre-et Loire*, troisième trimestre, page 19, 1824.

III. *The Fibrous Layer.*

This is not, strictly speaking, an aponeurosis ; neither is it periosteum simply, but a lamina resulting from the intersection of the two internal pillars of the inguinal ring, of the tendinous fibres of origin of the recti abdominis and internal muscles of the thigh : that is to say, that this layer is directly continuous with the femoral aponeurosis, and, by its anterior surface, with the preceding layer ; it also gives origin to the ligamentum suspensorium penis, and is by this means blended with the fibrous tunics of this organ ; as for the rest, it does not afford any particular application in surgery.

IV. *The Arteries, Veins, Lymphatics, and Nerves.*

As all the organs appertaining to these different systems, which enter into the composition of the pubic region, are simple capillaries merely, they merit no attention during operations, and unless they are enlarged by disease, they never can give rise to apprehension respecting hæmorrhage. The arterial ramuscles are derived from the external pudics ; those of the veins pass to the internal saphena, or under the arch of the pubis to the vesical veins ; the lymphatics principally enter the superficial glands of the groin : finally, the nerves are derived from the internal pudic.

V. *The Skeleton.*

This is the only important part of this region ; it comprises the anterior articulation, and all that portion of the pubes which extends to the spine of these bones. In the adult male this symphysis is remarkable for its solidity, so that its luxation is more difficult than its fracture at the anterior part of the pelvis ; which is owing to the inter-pubic ligament being incorporated, as it were, with the osseous surfaces.

In certain females, during pregnancy, this articulation is far from presenting the same degree of solidity : the fibro-cartilage swells, becomes softened, and its mobility sometimes becomes so

great as to produce halting, or to oblige the woman to keep at rest for several weeks previous to parturition. This relaxation of symphysis of the pelvis in general, and of that of the pubes in particular, hinted at by Galen and Fernel, demonstrated by S. Pineau, and denied, we do not exactly know why, by Baudelocque, is no longer the subject of contention. M Prof. Chaussier has had too many opportunities of meeting with it at the *Maternité* to admit of there being any further doubt respecting it. Favourable to labour, when the capacity of the pelvis is diminished, since it permits the dimensions of this cavity to enlarge in all directions, this state may also occasion serious consequences, when it is carried too far. We conceive that a similar disposition cannot but render *symphysiotomy* more easy, and from what has just been said it is evident that this operation cannot be dangerous as it regards the organs interested in its performance. Now, in order to perform it we will have to divide, 1st, the skin, having previously shaved it ; 2d, the subcutaneous layer, of greater or less thickness and interspersed with vascular and nervous filaments ; 3d, the fibrous layer ; 4th, the fibro-cartilage, in general so elastic as to require caution when dividing it, lest the scalpel being employed with too great force from before backwards should wound the bladder ; and unskilful accoucheurs (at the period when that scandalous dispute, too long fomented in our schools, was in agitation, whether the section of the pubes deserved the preference over the cesarean operation, as if these two operations could be mutually substituted for each other) have even penetrated as far as the womb. Be this as it may, the division of the triangular or sub-pubic ligament must be complete, if we wish to obtain any degree of separation, and the cellular tissue posterior to the symphysis must be drawn upon as little as possible, for, if it inflames, its lamellated disposition, its abundance and free communication with all the organs of the pelvis, will soon induce a profuse suppuration and occasion the greatest danger.

B. *The Penis.*

This organ is always appended to the pubes, which seem to give origin to it superiorly, whilst inferiorly, it is prolonged, by means of the canal of the urethra, into the perinæal region. It varies

greatly in magnitude and length, according to age, individuals, the state of erection or of relaxation: in the latter state it has the form of a cylinder bulging out towards its free extremity; it is then pendent upon the anterior part of the scrotum: in the first case, on the contrary, it presents a superior face having a groove of greater or less depth upon the median line, in which the principal vessels are lodged; laterally two rounded reliefs which correspond to the corpora cavernosa, and which are separated from the canal of the urethra by two grooves which are sometimes as deep as the superior; lastly, this canal forms a third relief upon the inferior face of the penis. Its root is generally a little thicker than the middle part of its body, and its anterior extremity usually expands in a very evident manner in order to form the glans.

CONSTITUENT PARTS.

I. *The Skin.*

Remarkable for its delicacy, tenuity and extensibility, the skin of the penis deserves a particular examination. Towards the root of this organ and upon its superior face, the skin is of considerable thickness, covered with hairs, and enclosing numerous sebaceous follicles; some lines further forwards, it becomes thin and smooth: posteriorly, and upon its inferior face, the hairs are less numerous, but the follicles are very large, prominent at its surface, and preserve these characters almost to the glans. The matter secreted by these organs concretes with the greatest facility, and frequently accumulates in the small cryptæ, in such a manner as to form granulations more or less numerous, which are occasionally observed under the body and root of the penis; granulations which sometimes acquire considerable volume and constitute perfect *tannes*, which may be easily evacuated by pressing them with the fingers from their adherent point towards their free surface. The colour of the integuments is deeper in this direction than in the former; they slide so easily upon the subjacent tissues, and their mobility in this respect is such, that we may draw them from the root almost to the glans and *vice versa*; whence it follows that in the amputation of the penis we

have two things to apprehend, either the leaving of more skin than the formation of the cicatrix requires, or removing so much that it will be impossible to prevent its receding from the wound. In the first case, it rolls upon itself, the edges of the wound are incurvated, and cicatrization is rendered very difficult; in the second, it retracts more or less towards the pubis, and leaves the stump uncovered. The latter consequence is more liable to follow the extirpation of a tumour of a certain volume; then, in fact, the morbid growth having pushed the penis backwards and drawn the integuments forwards, in order to form for itself an envelope, it follows that this membrane will appear to retract considerably after the operation. Consequently, if it is important, when we wish to remove this organ, to avoid drawing the skin too much towards its root, we should be still more careful not to draw it too much forwards.

In folding upon itself, in order to form the prepuce, the skin insensibly puts on the characters of mucous membranes; it assumes a reddish colour, and pours out an abundant secretion in the circular groove which separates the corona glandis from the body of the penis; it is well to note on this occasion, that the matter of this secretion sometimes becomes so acrid in persons not very cleanly, as to inflame, excoriate the parts and produce a discharge known by the name of *false gonorrhœa*; a discharge which has been, more than once, treated for many months as syphilitic, and which generally disappears, at the expiration of some days, under the use of simple emollient or dessicative lotions, according to circumstances. Where this groove terminates below the glans it forms a fold called the frænum of the penis, which approximates more or less the meatus urinarius, and which may be of various lengths. If it should be too short, or if it is prolonged too far forwards, it tends to draw back the glans upon the inferior surface of the organ, and prevents copulation, or renders it painful. If it is too long, the extremity of the penis is too much raised, and the ejection is not directed towards the neck of the uterus. In the first case, we make a section of this fold; in the second, we can do nothing.

The entire prepuce is a portion of a canal which is open anteriorly, and terminates posteriorly in a circular *cul-de-sac*; previous to puberty, it is narrow and very long; its aperture then is

sometimes so small that it scarcely permits the escape of the urine; whence it follows that, in certain children, the prepuce at length becomes transformed into a small pouch, in which this fluid accumulates before it makes its escape outwardly, and as several salts may be precipitated from it, we can readily account for the formation of the calculi which have frequently been observed in this enclosure. In the adult, this opening sometimes retains the narrowness of infancy, in which case it may also impede the expulsion of the urine, but especially render the act of copulation difficult by preventing the glans from being uncovered. As, on the other hand, it opposes the cleansing of the interior of this membranous sac, the sebaceous matter, more acrid, and secreted in greater abundance than usual, often occasions the discharge we have just spoken of. It may also happen that this aperture, allowing the glans to pass through it with some difficulty during relaxation, completely refuses it during erection, and the same thing might equally happen if chancres or inflammation of the internal surface of this small pouch supervene. The latter, is an accidental *phymosis*; the former, a congenital phymosis, which may be removed in the child or adult, by dividing the superior paries of this envelope with a bistoury, in preference to making use of the scissors. But, in performing this little operation, it is important that the skin should not be drawn forwards at the moment when the point of the instrument, introduced between the prepuce and the glans to the bottom of the cavity, is about to perforate the tissues from within outwards, in order to terminate the section from behind forwards. For, without this precaution, the integuments, properly so called, would be found divided some distance beyond the corona glandis.

This infirmity may likewise be removed by *circumcision*, that is to say by removing that prolongation of the prepuce which extends beyond the extremity of the penis; but this method is productive of two special inconveniences: thus, should we remove so much skin as to uncover the glans, this organ will always remain naked, and unpleasant consequences may result from it; if, on the other hand, we merely remove the apparently superfluous part, the circular division, in cicatrizing, becomes rigid, and the opening is frequently narrower after the cure than before the operation.

Furthermore, the prepuce is susceptible of a considerable elongation, and in cases of cancerous tumours which are sometimes developed in it, a phenomenon occurs which deserves to be mentioned, on account of the gross mistakes which it has given rise to. In these cases, in fact, or in consequence of tumefaction, or any form of disorganization, the absolute length of the prepuce is augmented, the skin of the body of the penis is drawn forwards by the tumour, whilst at the same time the penis is actually pushed backwards; then, if amputation becomes necessary, it may happen that the glans may be supposed to have been removed by the operation, when merely the double cutaneous layer which envelopes it has been cut off; and it is in this manner that we may account for those pretended reproductions of the penis, which have been so much boasted of as marvellous facts by surgeons of former times.

The narrowness of the preputial orifice is also capable of producing another kind of accident; for instance, it is possible with some exertion, to uncover the glans and to draw the cutaneous ring behind the corona, where the penis is of lesser volume, but afterwards be unable to bring it forwards again, in which case the strangulation consequent upon it may rapidly produce gangrene, or simply occasion inflammatory phenomena of various degrees of intensity. Under similar circumstances, we conceive that it would be necessary to resort immediately to refrigerants, compression, and every possible means of diminishing the volume of the glands, in order that it may be pushed behind the prepuce, whilst at the same time we use every endeavour to draw the latter forwards. But if inflammation is already present, and the constriction very great, we can only expect to avoid the dangers which are impending by cutting the stricture in several points, always taking every possible care to avoid wounding the cavernous body. As this accident, called *paraphimosis*, is principally owing to the enlargement which the penis undergoes during the erection produced by this species of constriction, it follows that it must be very rare in children, in whom, however, it is sometimes observed. Finally, the skin of the penis, and especially of the prepuce, is so thin, that in infiltrations it becomes quite transparent.

II. *The Subcutaneous Layer.*

This is evidently only a prolongation of the fascia superficialis, or, if we prefer it, of the elastic cushion of the pecten (*pénil*) : it is supple, soft, extremely extensible, divisible into a great number of laminæ, always destitute of fat, unless it is near the symphysis of the pubes, and but very loosely adherent to the layers between which it is situated. It is to these remarkable characters of the subcutaneous layer, that the skin owes the most of its peculiarities, and especially that great mobility which we have recognised in it. It is prolonged into the cutaneous duplicature which forms the prepuce ; but there, all the elements are almost confounded, and in such a manner that inflammation may produce in it purulent abscesses which will remain circumscribed for a long time ; whilst, in the other points, the morbid fluids spread with the greatest facility from one place to another ; so that abscesses of the penis should be early opened, if we wish to avoid the detaching of the cutis. This layer encloses the principal vessels and nerves, and its thickness gradually diminishes in proportion as it approximates the free extremity of the organ. But, notwithstanding, as it is as soft there as elsewhere, it follows that infiltrations, which so readily take place in the body of the penis, accumulate in it with even greater rapidity ; and there is also this remarkable in it, that as this layer is included between two cutaneous laminæ which are not supported by any solid body, it admits fluids with greater facility, which causes a considerable elongation of the prepuce, and more or less contraction of its orifice. Inflammatory phymosis is often produced by the same mechanism.

III. *The Fibrous Membrane.*

This constitutes, if I may so say, the skeleton of the penis ; at least it determines the form, volume and density of it. It forms a cylindrical canal, which is double posteriorly, and single anteriorly ; that is to say, admitting it to be but one canal in the first place, it is divided into two, in its three posterior fourths, by a vertical fibrous septum, which insensibly disappears

in its anterior fourth portion. This membrane is itself composed of very dense and strong fibres, which are diversely intersected near the pubis; it is about a line in thickness, but becomes gradually attenuated as it passes to the glans, where it is no longer but a simple fibro-cellular lamina, sufficiently compact, however, to prevent any direct communication between this organ and the cavernous body. Its inferior surface presents a groove in which the urethra is lodged; so that the latter is in fact united to the body of the penis only by a filamentous cellular tissue, which permits us to isolate these two organs completely: a second groove exists upon the dorsal surface of this canal, and both correspond to the median septum. From its internal surface a very great number of fibrous filaments are given off which interlace each other in the canal, forming a net-work somewhat similar to that which is observed in the cavity of long bones. This network serves to support the minute ramifications of the veins and arteries, in order to form the spongy, erectile tissue called *cavernous*.

From all these peculiarities of structure, it follows that the enlargement of the penis is insuperably limited by the resistance of its fibrous canal; that cicatrices, consequent upon wounds which have penetrated this canal, generally change in a greater or less degree the direction of this organ; that during forced erection, as happens in priapism, or intense gonorrhœa (*chordée*), if we endeavour to curve the penis suddenly, it *breaks*, as it is commonly called, sooner than it will bend, because the tunic under consideration becomes lacerated, and we conceive that these lacerations may be attended with hæmorrhage from the urethra, if the latter canal is included in the solution of continuity. It is in this way that we may naturally account for the relief which patients experience after the occurrence of this accident; but an incurable aneurismatic or varicose fungous tumour may be the result, and may be attended with painful or very difficult erections.

IV. *The Arteries.*

The two dorsal arteries of the penis are enveloped in the sub-cutaneous layer, and ascend from behind forwards in the median groove; they sometimes anastomose and become blended with each other upon entering this groove, so as to form but one ves-

sel. Their volume is so considerable until they reach the prepuce that surgeons have advised making the incision for phymosis inferiorly or laterally, in order to avoid the hæmorrhage which might ensue from their division; but such apprehensions are unfounded, and the points indicated for the section being less suitable, we continue to incise the prepuce superiorly and upon the median line. After amputation of the penis they sometimes retract very far backwards, and for two different reasons: in the first place, because they run in a very supple and very moveable layer which does not impede their retraction in the least: and in the next place, because the albugineous envelope of the cavernous body does not permit the stump to follow the retraction of the cellular and cutaneous tunics, and therefore the arteries appear to recede the more.

The two cavernous arteries (*arteriæ profundæ*) which are found in the cavernous tissue externally, and slightly inferiorly near the fibrous membrane, do not retract at all after this operation, because the network of the erectile element prevents the retrograde movement. After the removal of penis then, we have to secure four arteries; two superficial and two deep-seated, besides some twigs from the principal branches. All these arteries are derived from the internal pudic, and to these we may add some twigs which come from the artery of the septum and the external pudics.

v. *The Veins.*

The venous system is very freely distributed throughout this organ; it forms almost the whole of the cavernous tissue, and there are also very large veins beneath the skin, which are interposed between the laminæ of the subcutaneous layer; they sometimes become swollen so as to produce pain during coition, and even undergo excoriation; so that a species of hæmorrhage is not unfrequently the consequence. The largest accompany the dorsal arteries, and pass under the arch of the pubis in order to empty into the vesical veins: hence it is advantageous to draw blood from them in acute diseases of the bladder, of its neck, or of the interior of the pelvis. It has also been advised for inflammatory affections of the penis itself, and we think very properly; but it

is attended with some difficulty, because it is not easy to make the necessary compression, unless the diseased organ is in a state of erection; therefore, in order to succeed, we must make pressure with the thumb near the pubis, whilst at the same time we puncture the vein with the lancet. Moreover, it would not be impossible to wound at the same time the corresponding artery as well as the nerve. This venæsection is scarcely ever adopted at present, and it is probably undeservedly neglected. Some small veins from the lateral and inferior parts also empty their blood into the saphena major through the medium of the external pudics; but they present nothing particular.

VI. *The Lymphatics.*

Some accompany the cavernous arteries and veins and enter the pelvic glands; the others creep in the superficial layer, are larger upon the dorsal or lateral faces of the organ and pass into the glans of the groin, through which the lymphatic vessels of the glans and the greater part of those of the canal of the urethra also take their course: hence it follows that chancres, or other diseases of the glands and prepuce, so frequently produce buboes in the inguinal region, and that these buboes may be efficaciously treated by mercurial frictions applied to the penis; whilst deep-seated disorganizations of the corpus cavernosum, without lesion of the exterior layers, usually excite correspondent diseases within the pelvis.

VII. *The Nerves.*

They are derived from the internal pudic nerve and follow the same direction as the arteries, ascending on their outer side. They might be easily wounded, as we have noticed, in puncturing the dorsal vein; but may be avoided by puncturing the vein lengthwise, not deviating from the median line. In wounds, or during amputations we must recollect that they run by the side of the arteries, in order that we may avoid including them in the ligature which we are obliged to apply upon these vessels.

The next part in order is the canal of the urethra, but as we wish to describe it as a continuous canal in relation to catheter-

ism, we must necessarily defer its description until we come to the perineal region. At present, however, we will mention, that in expanding anteriorly it constitutes the glans, a species of cap which envelopes the free extremity of the cavernous body, and that after the section of the virile member, it is customary to introduce a catheter into it, in order to prevent the urine from inundating the wound, and the diminution or obliteration of the orifice by the contraction of the cicatrix. This practice is doubtless useful and prudent; nevertheless, when it has been neglected, the cure has, in some cases, been equally complete. A man aged seventy-four years came to the Hospital of the Faculty, in the summer of 1824, with a cancer of the penis. After the amputation, this stubborn man would not permit a bandage to be applied to the wound, or the catheter to be introduced; notwithstanding, the cicatrization, which went on regularly, was complete at the end of five weeks.

We may likewise observe that wounds of the penis will be rendered more dangerous at the inferior surface, by the presence of the urethra, than at the dorsal surface, where the arteries, nerves, and some veins are situated; but, it is evident that the first would be followed by urinary fistulæ; whilst the latter can only become troublesome from hæmorrhage or some nervous disturbances.

The order of super-position here, is very simple; we meet with, 1st, the skin, covered with hairs posteriorly, enclosing sebaceous follicles throughout its whole extent, and particularly distinct upon its inferior surface; very extensible, and consequently permitting the immediate re-union or linear cicatrization of very extensive wounds; 2d, the subcutaneous layer, in which we find the superficial veins, arteries, and nerves; 3d, the *theca propria* of the corpus cavernosum, divided by a middle septum almost to the glans; 4th and lastly, the cavernous tissue itself, composed of veins and arteries spread out into a fibro-reticulated structure, and including, besides, the cavernous artery.

c. *The Scrotum or Testicular Envelopes (Bourses).*

This species of sac contains the testicles and their cord; it is firm, of small volume, broader at its base than at its summit, in

children, young subjects, and when suddenly exposed to cold; elongated, soft, pendulous, and fixed as it were by a single pedicle to the pubis, in adults and old persons; superiorly it seems to bifurcate in order to embrace the root of the penis, and is continuous with the external abdominal rings; inferiorly, it is prolonged upon the median line of the perineum by a soft eminence, and is separated, upon the sides, from the thighs, by two deep grooves, in the bottom of which we frequently observe excoriations, especially in very young children. Finally, we have seen its two portions remain isolated and bearing an imperfect resemblance to the labia pudenda of the female; and hence doubtless many of those histories of hermaphrodism, so common among the ancients.

CONSTITUENT PARTS.

I. *The Skin.*

The skin of the scrotum, like that of the penis, is very thin, soft, extensible, and possessing great mobility; but it is also covered with hair and follicles which form as many granulations upon its free surface; its colour is always deeper than that of the surrounding parts, and its aspect is rugous: when the body is heated by labour it becomes relaxed and elongated; when exposed to cold, on the contrary, it contracts and is corrugated. From its anatomical characters it follows, that its secretory action is very energetic, and that the secreted matter, accumulating in the wrinkles which it presents, easily receives foreign corpuscles, and thereby promptly forming a more or less irritating crust, which is the principal cause of a great number of those diseases which have their seat here, such as cutaneous eruptions, *dartres*, for example. Many reasons induce us to believe that the disease so well described by Percival Pott, under the name of *chimney-sweep's cancer*, may be equally attributed to this peculiarity. Upon the median line we observe a species of seam which continues itself, on the one part, under the root of the penis, and, on the other, is prolonged backwards towards the anus. This line constitutes the *raphé*, and may serve to guide us in the incisions which we practise upon the scrotum. In consequence of the

great extensibility of the skin of the scrotum, when we extirpate tumours which have their seat beneath it, we may, without inconvenience, remove a much greater portion of it than of the same membrane in any other part of the body, and that, in sarcocele for example, by grasping the part with the hand in order to sweep it off at one stroke, according to the advice given by Doctor Kern, of Vienna, and in the same manner that we would amputate the penis, cicatrization takes place as well, and sometimes, immediately, much better than if we had dissected the integuments with the most scrupulous attention.

We may also remark that the hairs may become the cause of pretty acute pains, when they have been cut in the adult, especially if he is obliged to walk much during the first few days subsequent to this operation: for their free extremity then remains stiff until they have grown of sufficient length to bend, and as these points produce friction upon the skin of the inner part of the thighs, pain and even excoriations are liable to follow, the cause of which is not always immediately apprehended.

II. *The Subcutaneous Layer.*

It is possible to divide it into several laminæ, which are, in fact, only different sheets of the *fascia superficialis*. This layer, which is called *dartos*, is double, that is to say, there is one for each side. In order that we may have a distinct comprehension of it, it is necessary to consider it as it exists in the fœtus previous to the formation of the scrotum, and as a fragment of the general subcutaneous fascia: then, in fact, we will see that it sends a canaliculated prolongation, in the form of a tunnel, through the inguinal ring into the abdomen as far as the testicle, which, in descending, pushes this species of *glove-finger* (*doigt de gant*) gradually before it, so as to expand it completely when it has fallen entirely into the scrotum. When matters have arrived to this point, the dartos constitutes two perfect pouches which are distinct from one another, being only joined together at the internal part of their external surface, in order to form the double septum which separates the testicles below the urethra and the penis. This membrane is likewise evidently continuous with the cellular layer of the perinæum, of the inguinal region.

abdomen and penis. In some subjects its fibres are supple, villous, and reddish; so that upon this appearance the ancient anatomists, who attributed the corrugation of the scrotum and the retraction of the testicles to the contractions of the dartos, founded their opinion of its muscular structure. It is true that the cremaster muscle sufficiently accounts for these movements of the skin and of the seminal glands; it is equally true that this opinion respecting the muscular nature of the dartos has been long since rejected; nevertheless, we have before us at present a subject in which this fleshy structure is evident, in the layer under consideration; its fibres are parallel, undulatory, villous, soft, very supple, reddish; in a word, they present all the characters which appertain to the muscular membrane of the stomach at the moment the œsophagus expands, if I may so say, upon this viscus. This structure is still more distinct upon the perinæal portion of the urethra, so that, if we dared to promulgate our opinion on this subject, we would say that it is in the nature of the cellular tissue to be able to transform itself into muscular tissue; but this is not the place to discuss this point of general anatomy.

It is in the subcutaneous layer that hydrocele by infiltration (*œdema of the scrotum*) is situated, and we conceive that this disease may be consequent upon a similar affection of the abdominal parietes, perinæum, or of the pelvic extremities; it is between its lamellæ also that the pus derived from abscesses of the surrounding regions infiltrates, that the urine is extravasated when the urethra is ruptured, that the liquid which we attempt to inject into the tunica vaginalis is propelled when the canula is not properly maintained, and that the blood is effused, when the external pudic arteries have been wounded. The arrangement of these laminæ further explains the facility with which these extravasations produce sudden and violent disorders, and, in all these cases, furnish the indication of dividing the skin promptly and extensively, when we apprehend the formation of a purulent collection under the integuments of the scrotum.

There are but few adipose cells contained in this layer, but as it ascends upon the cord or descends towards the perinæum, they become more abundant: therefore, in polysarchia, these last points become of greater or less thickness, whilst upon the

pouch of the testicles the subcutaneous layer remains the same : whence it follows that the scrotum seems, proportionately, much less voluminous in persons who are fat than in those who are emaciated.

III. *The Fibrous Tunic.*

This is the first which is moulded upon the testicle and its cord ; we have already seen, when treating of the inguinal canal, that it originated from the circumference of the ring of the external oblique, and that it was distinctly continuous with the fibro-cellular web of the aponeurosis of this muscle. Its texture is at first pretty compact, afterwards it becomes more lax, and in descending soon assumes the softness and all the characters of simple cellular tissue ; at its inferior part it is so much confounded with the preceding that it is generally almost impossible to separate them. In herniæ of long standing this tunic sometimes acquires a great thickness, so that, if the viscera should escape through a rent in it, it might give rise to all the phenomena of strangulation. We may observe, however, that this accident is scarcely possible, except in the anterior part of its superior half, on account of the greater degree of extensibility which it possesses in the remaining portions.

IV. *The Muscular Tunic or the Cremaster.*

We have already noticed that this sheath was an appendage of the internal oblique muscle, and that its fibres formed as many loops, the extremities of which entered the inguinal ring, the longest embracing the testicle. In many persons the fibres of this muscle are slender and almost indistinct, whilst in others it is very strong, and we know, without the possibility of a doubt, that it is the principal cause of that action by which the scrotum is drawn up and the testicle applied against the ring in young and robust subjects. In old herniæ it undergoes changes which are worthy of notice : it sometimes acquires such a degree of thickness that it has been supposed capable of reducing the her-

nia by its own contractions:* and since the time of Sharp and Monro, all surgeons, except Pott, Richter and Walter, have mentioned that the cremaster muscle was sometimes very thick around the hernial sac; we may even say with Scarpa, that this thickening of the fleshy tunic, together with a similar state of the other envelopes, has induced a great many practitioners who have written on this subject to believe, that in large and old herniæ the peritoneal sac, properly called, became by degrees of considerable thickness. In hydrocele, it has given rise to a similar error, and, more than once, have they attributed to the tunica vaginalis what actually appertained only to the tunica erythroïdes (*cremaster muscle*) and to the exterior envelopes. Be this as it may, we must expect, when we perform the operation for strangulated hernia or puncture a hydrocele, if the tumour is voluminous and of long standing, to meet with a considerable thickness of parts; whereas, if these diseases are recent, all the membranes will be thinner than in the natural state; circumstances with which we should be well acquainted, in order that we may not be embarrassed by the depth to which we must sometimes penetrate, or by the promptitude with which we arrive at the hernial sac or the tunica vaginalis.

Finally, when the muscular sheath has been long distended by the neck of the sac, it appears as if it originated from the circumference of the ring, and it is so confounded with the fibrous tunic that these two laminæ form only one aponeurotic and fleshy layer. It seldom happens, under any circumstances, that fat accumulates or infiltrations are seated between these two laminæ.

v. *The Cellular Tunic.*

This envelope is one of the most remarkable, and is generally designated by the name of "*proper tunic*" of the cord; it is essentially formed by the *fascia propria*, or, if we prefer it, by the cellular tissue which invests the peritoneum; besides this, we may say that it is enveloped by another tunic appertaining to the *fascia transversalis*, since the testicle cannot draw it along without passing through the opening of the latter fascia, or rather

* J. L. Petit, tome premier, page 298.

driving this fascia before it in the form of a funnel. From this circumstance the sheath of the cord does not envelope the tunica vaginalis; it stops at the place where the vas deferens originates from the testicle: whence it follows, as Scarpa has very correctly observed, that, in inguinal herniæ, unless they are congenital, the viscera and the sac stop above the seminal gland, which, always pushed inwards and backwards, is slightly united by its external surface to the fleshy membrane (cremaster): frequently in fat subjects, we find the surface of this tunic covered by an adipose layer of considerable thickness, or merely by fatty lumps of various dimensions, which may be the primary cause of some herniæ, and likewise form of themselves fatty herniæ when they acquire considerable volume. This is a disposition which cannot but be embarrassing when we endeavour to discover the sac in herniæ properly so called. Scarpa says that he once found serosity effused between this tunic and the cremaster. Furthermore, it is connected to the constituent parts of the cord by means of cellular lamellæ or filaments of considerable firmness; so that fluids may accumulate from space to space and thus form pouches or isolated cysts, which constitute what are called *encysted hydrocele of the cord*. On this occasion it should be observed that these tumours will always be situated between the testicle and the ring, since the proper tunic terminates at the entrance of the vessels into this gland: nevertheless, as the cellular tissue is prolonged, posteriorly, along the epididymis, in order to attach itself to the other tunics, we conceive the possibility of an encysted hydrocele in this direction. In this disease the cord is almost always thrown inwards and backwards, because it is anteriorly that the cellular lamellæ are the least adherent; a circumstance which must not be forgotten, when we wish to perform the operation, in order to cut or introduce the trocar upon the anterior and external part of the tumour. These accidental cavities do not communicate with the interior of the peritoneum; hence we may with perfect safety inject irritating fluids into them, in order to effect their obliteration: finally, this disease is susceptible of receiving the different methods of treatment recommended for the radical cure of hydrocele of the tunica vaginalis.

VI. *The Serous Membrane.*

In the adult it represents a small shut sac, which we may consider as formed of two portions; one, which adheres by its external surface to the *cul-de-sac* of the fibro-muscular membrane; the other, which is intimately united to the surface of the testicle, in such a manner, however, as not to cover this organ entirely, but leaves some part of its root, that is to say, the portion which receives the vessels and the vas deferens, enveloped by the cellular tissue, and fixed to the internal surface of the other sheath. From this peculiarity we may very naturally explain how it is, that, when the cavity of this membrane is filled with fluid, the testicle is always towards the internal, posterior and superior portion of the tumour. Therefore, we ought always, as in encysted hydrocele, to introduce the instrument at the anterior external and inferior point. Superiorly, the tunica vaginalis is continued as far as the posterior opening of the inguinal canal, by means of a cord, which is nothing more than the vestige of a canal which naturally existed previous to birth between this pouch and the peritoneum, of which it is only a prolongation. Now, the viscera may insinuate themselves into this canal during foetal existence, and the infant will be born with a hernia, in which the protruded viscera will be in immediate contact with the testicle. If this hernia, denominated congenital, persists after birth, it exposes to the same accidents as any other: but it must always be recollected that, in this case, the hernial sac is the tunica vaginalis itself; so that, in operating, we must not expect to find the external surface of the immediate envelope of the viscera free, and susceptible of being easily separated from the others. Here, strangulation is rare, because the whole canal, and the ring especially, are ordinarily very much dilated. Besides, when this phenomenon does manifest itself, it is generally produced by the neck of the sac, the opening in the fascia transversalis, or by both combined. We have previously remarked that in the ordinary form of hernia the cellular tunic arrested the organs above the testicle; in that which now occupies us, on the contrary, the tunica vaginalis permits them to descend much lower down: but always, as in hydrocele, the gland and the cord are repelled inwards and backwards. In the

fœtus at the full period, this canal is usually obliterated; only it sometimes happens that its cavity remains free in different points of its extent, notwithstanding all communication with the abdomen has ceased. In such cases, if fluids should collect in these separate cavities, a distinct species of hydrocele of the cord results, which differs materially from that which we have just pointed out, as it regards the seat which it occupies, but which requires the same method of treatment.

In the natural state, the tunica vaginalis is thin; its interior is smooth and forms a very regular cavity; but when the fluid which naturally lubricates it accumulates in it in great abundance, or when the hydrocele has existed a long time, it sometimes becomes enormously distended, ascends towards the ring, enters partially into the inguinal canal, and then, from the constriction which it experiences, the tumour assumes the form of an hour glass, as has been observed by M. Dupuytren.* It becomes uneven, is sometimes covered with cartilaginous patches, hardens, in short, becomes dense, so that its perforation with the trocar will be attended with some difficulties, and that, after the puncture, its sides instead of collapsing and coming into contact will remain distended. In such cases, excision is the only proper treatment, because it is not possible to produce adhesion of its surfaces. There are two other ways also in which the tunica vaginalis becomes thickened, which are still more frequent: in the first place, by the thickening of the envelopes already examined, and in the next, by the superposition of albuminous strata on its internal surface, which become organised in the same manner as in chronic inflammations of the pleuræ. But in whatever way this thickening may occur it should be noticed, because it destroys the transparency of these tumours and consequently renders their diagnosis more difficult, and also because they oblige us to penetrate to a greater depth, in order to reach the cavity of the pouch. Finally, we conceive that all that is necessary for the cure of hydrocele is to produce an obliteration of the vaginal cavity, and that in order to accomplish this end we may profitably resort to incision, excision, cauterization, the seton, tent and the injection, since all that is required is to inflame this sac, so that its parietes may become coherent.

* Sabatier tom. 3, page 20.

If, after the formation of this membrane, the peritoneal canal persists at birth, it may become filled with fluid, in the same manner that a congenital hernia is formed, thus producing a hydrocele of the same species. This kind of effusion, first described by Viguerie, deserves attention in the treatment, for the inflammation which we then produce must readily transmit itself to the peritoneum : the process by injection especially appears dangerous, unless we completely obliterate the inguinal ring by a suitable compression made at the same time that we are throwing in the irritating liquid ; a method which we have repeatedly seen attended with success. It also sometimes happens that the tunica vaginalis, protruded by the serosity whilst the testicle is retained in the abdomen, or behind the ring, forms a species of congenital hernia, in which there would be no important organ endangered by the operation.

Recapitulation. In consequence of the anatomical disposition of the serous sheath of the testicle, it will admit of the formation of a simple hydrocele, without any communication with the peritoneum ; of a congenital hydrocele, or with communication, and which may co-exist with a hernia of the same species ; of an unilocular or multilocular hydrocele, from the seminal gland to the ring, in consequence of the incomplete obliteration in one point or from space to space of the natural canal of communication, and which we may call encysted hydrocele of the tunica vaginalis ; finally, of an encysted hydrocele external to this tunic, or in the cellular tissue of the cord ; as these last species sometimes exist under the form of hydatids in the inguinal canal, or very near to its external orifice, they may impose upon us for a bubonocoele, and this mistake has been committed more than once.

In all these varieties, the organs which must be avoided during the operation are always situated in the same direction and exact the same precautions, unless it is in those cases in which the testicle is behind the ring and where the peritoneal communication persists. But when we adopt the method by injection, the arrangement of the membranes demands further attention, if we wish to avoid unpleasant consequences ; we mean to say that, as the fluid escapes the tunics retract and collapse ; if the canula, therefore, is so held that it does not follow this retractile movement, its extremity, notwithstanding it may have been well

placed at first in the serous cavity, will slip from it, and pass between it and the other layers; so that, if the surgeon did not discover it in time, the liquid would be forced into the interval of the envelopes of the scrotum, and we may easily infer all the consequences which would result from it.

Be this as it may, in the operation for hydrocele, we only arrive at the sac after having traversed, 1st, the skin; 2d, the subcutaneous layer, or the *dartos*; 3d, the external fibrous layer; 4th, the fleshy tunic or *tunica erythroides*; 5th, the cellular or internal fibrous layer, but only in those cases where the disease is an encysted tumour of the tunica vaginalis or of the cord; and 6th, the serous or vaginal tunic.

Since, in congenital hernia, the viscera are collected in the same sac with the testicle, we are obliged, in the operation, to cut through the same envelopes, and in the order just indicated.

VII. *The Testicle.*

From the course which this organ takes during intra-uterine life in order to escape from the abdomen, it may stop behind the ring of the external oblique or of the fascia transversalis; so that sometimes, even in the adult, we do not find the testicle in the scrotum. Such is doubtless the origin of the details of pretended absence of the secretory organs of the semen: at least, we have not had a well authenticated case in man wherein these glands did not actually exist. The case related by Cabrole, of Montpellier, notwithstanding he states that he dissected the subject, is not of a nature to make an exception to this observation.

Further, when the testicle stops in the canal, or when it tends to escape through the ring, the pressure it experiences and the tumour which it forms have given rise to the belief that a hernia is commencing or even strangulated; and we may readily conceive the serious consequences which would result from such a mistake if we endeavoured to push back the projection, and especially if we attempted to support it with a bandage. It is possible, however, that it may be repelled in some children without serious inconveniences, and, in such a manner, that it will remain behind Poupart's ligament, and at a later period protrude by the

crural arch, an example of which is related by Scarpa, and to which we will refer when we come to speak of crural hernia.

The species of fibrous shell, of *albugineous membrane* which immediately envelopes the proper substance of the testicle, is so adherent to the external face of the tunica vaginalis, that it is scarcely possible to separate them by dissection: nevertheless, hydatids, or other small cavities sometimes form between them, which acquire a greater developement as they approximate the posterior margin of the organ, because the lamellated cellular tissue is there a little less compact; the internal face of this membrane, like that of the fibrous tunic of the penis, also sends off filaments which intersect each other in the interior of its cavity, serving to support the seminiferous tubes; but they are very delicate and possess but little solidity: whence it follows that, when the testicle is wounded, the secretory substance promptly escapes. Upon this subject we may recall to mind a case related by J. L. Petit, in which the surgeon extracted every day a portion of the seminal ducts, thinking that he was removing mortified cellular tissue: so that he thus completely drew out the gland, in the same manner that one would unwind a ball of thread.

It is this which constitutes the *Corpus Highmorianum*, through which pass all the canals which it encloses; it also seems to continue itself upon the epididymis and vas deferens, where it would then present much less thickness. Hence it follows that, even in the swelling which may follow gonorrhœa or any other discharge from the penis, the tumefaction sometimes remains confined to the epididymis for several days before it becomes manifest in the testicle itself: although the tunica albuginea is strong, thick, and possesses but little extensibility, testicular tumefaction takes place with great rapidity; but this depends upon the delicate, extensible, very supple and pretty abundant cellular tissue which is mingled with the glandular filaments. Nevertheless, the volume of this engorgement seldom exceeds certain limits without disorganization of the membrane taking place; and, as it yields sooner in one point than in another the tumour becomes knotty and irregular, as we observe in cancers, for example; then, when it gives way in one or more points, the swollen tissue enclosed within its cavity, tends to escape through these openings, and it is soon

covered with vegetations. From its anatomical relations, it may generally become affected in two different manners: either the disease will be transmitted to it by the tunica vaginalis; or, on the contrary, it will become disorganised consecutively to the proper tissue which fills it. The first case is usually comparatively mild; it is observed in acute or chronic hydroceles, and generally disappears with the disease which produced it. The second, which comprises the different species of swellings of the testicle, properly so called, whether simple, venereal, or cancerous, is much more dangerous.

The *Epididymis*, being at the posterior and superior part of the testicle, is somewhat firmly fixed to the membranes which form the scrotum; it is upon this that the *gubernaculum testis* exercised its tractions, and to which it remains attached even in the adult; so that this adhesion always prevents the gland from being entirely free in the serous membrane, and causes effusions, when they do occur, to form a tumour anterior and external to it. Furthermore, it is necessary to note that in some subjects its volume is so considerable as to induce the belief that a pathological tumefaction exists; and, indeed, it may be slightly engorged for a long time, without necessarily giving cause for any apprehension.

Thus, the structure of the testicle explains, on the one part, how it is that hydrocele may continue for years, and even for life, without destroying the functions of this organ. Its fibrous tunic forms for it a species of barrier beyond which the disease rarely extends; on the other, it leads us to comprehend why scirrhus, which commences in the centre of the organ, as well as all other affections which arrive in it, if I may use the expression, by the vas deferens, such as gonorrhœal engorgements, etc., why, I say, these diseases so very slowly produce any alteration in the membrane, not even serous effusion, with which moreover, it is so frequently affected. It also explains the dangers which would follow from not effecting an immediate reunion of wounds which penetrate to the seminiferous tubes, as well as the difficulty of curing the fistulous ulcers which result from these wounds, when they have not been properly treated; finally, it accounts for the nature of the pains we experience, when the testicle is bruised or compressed in any manner whatsoever.

VIII. *The Testicular Cord.*

When we examined the spermatic cord in the inguinal canal, we pointed out the organs which entered into its composition and the mechanism of its formation; consequently, we know that it is constituted by the vas deferens, the spermatic artery and veins, a branch of the epigastric artery, the genito-crural nerve, the spermatic (*testicular*) plexus of the great sympathetic, the vestige of the canal of communication of the tunica vaginalis with the peritoneum, and lastly by cellular tissue which forms the bond of union between these different parts.

(*a*) The *Vas deferens* is here the essential organ; it is most frequently situated internally and posteriorly; so that if we divided the stricture of a crural hernia in man directly upwards, the instrument would cut this canal before it reached the vessels. It may always be distinguished by its flattened form, its grayish colour, and its position, so that it may easily be isolated. Although it does not receive nerves from the cerebro-spinal system, it cannot be included in a ligature without danger, and without producing extremely acute pain, of a peculiar nature, which promptly tends to determine syncope.

(*b*) The *Spermatic artery* is almost constantly external and anterior to the excretory duct of the testicle; it is generally single as far as the inferior part of the cord, and its volume is sometimes so great, that it might, if wounded, give rise to a troublesome hæmorrhage, as, for example, in hydroceles and herniæ of large size and long standing; then, as the cord is, as it were, decomposed, this artery may lie upon a part of the tumour where it is not usually situated; therefore, authors have advised us to observe it carefully, when we approach the sac, in the operation for hernia; and Scarpa, in particular, has shown that it may be wounded in puncturing a hydrocele, more especially as, in these diseases, each of its branches of termination is sometimes more voluminous than the trunk itself.

(*c*) The artery given off by the *epigastric* is seldom large, and does not always reach the testicle, that is to say, that it distributes itself in the laminæ of the scrotum; so that we have nothing to apprehend from its puncture in operating for hydro-

cele; but after the extirpation of the testicle it requires a ligature as well as the preceding. It is then that we must recollect that one is external, the other internal, and that both are anterior to the vas deferens. Slender in proportion to their length, flexuous, soft, and included in a layer of lamellated cellular tissue, they promptly retract after their division, so that it sometimes becomes difficult to find them when we do not tie them immediately; it is true, that by tying the cord *en masse*, we necessarily comprise them; but is not this method of proceeding attended with other dangers? We will revert to this question again.

(*d*) The *Spermatic Veins*, tortuous, undulated, very large, two, three, four, and even more in number, may be distinctly traced as far as the epididymis, and are generally placed at the sides and behind the other canals. As their length is considerable, their tunics very soft, as they are continually drawn upon by the weight of the testicle, enveloped in cellulous lamellæ of but slight density, exposed to compression in the inguinal canal, on account of the double curvature which they are obliged to undergo, and as they are equally subject to pressure in the iliac fossa upon the fore part of the *psoæ* muscles, it is by no means surprising that they should be frequently affected with varicose dilatations, and that varicoceles should sometimes become very voluminous. The species of knotted chain which they form when in this state, gradually increases in proportion to their approximation to the testicle; because their branches are so much the more numerous as we arrive nearer the inferior extremity of the cord.

(*e*) The *Nerves* are so arranged that the bundle derived from the trisplanchnic (*spermatic plexus*) lies upon the spermatic artery, that the genito-crural is situated behind it, and the ilio-scrotal runs in the fibres of the cremaster muscle, consequently without the cord; so that by the last two we may readily account for the pain, more or less acute, which is felt towards the crista of the ilium and the lumbar region when an irritating fluid is injected into the tunica vaginalis; whilst that peculiar kind of pain produced by the same operation or by compression of the testicle, a pain which patients say "strikes to the heart," and which, in fact, soon occasions syncope, must be referred to

the spermatic plexus. Finally, as this plexus and the vessels which it accompanies, have intimate relations with the kidney, we may easily comprehend why a retraction of the testicle occurs from nephralgia and the formation of renal calculi. By tying the arteries separately, after the removal of a sarcocoele, it is supposed that these nerves may be the more certainly avoided; but, generally, they are too delicate and too close to the arteries to admit of their being always excluded from the ligature; besides, when the entire cord is tied, it is sufficient to act promptly and forcibly in order to interrupt completely all action and cause an immediate cessation of these pains.

(*f*) The *Cellular Tissue* of these divers branches communicates directly with that which covers the external surface of the peritoneum, where it furnishes a sheath to each of them; it appertains, properly speaking, to the tunica propria of the spermatic cord; it is in the interval of its laminæ that encysted hydroceles of the cord are particularly developed, laminæ which also admit of the infiltration of fluids effused between the plates of the fascia propria.

(*g*) With respect to the *Ligament* of the *Tunica Vaginalis* it has been previously spoken of, and we will again have occasion to resume the consideration of it.

IX. *The Arteries of the Scrotum.*

In addition to the proper arteries of the spermatic cord, the scrotum receives a great many more, which ramify in its envelopes and especially in the subcutaneous layer; so that in the operation for sarcocoele and oscheocoele they are frequently divided at the first stroke of the bistoury. As the layers in which these vessels run are extremely supple, soft, and moveable, it follows that their divided extremities will retract with promptitude under the skin, therefore they should be secured immediately on their division, and not left until the close of the operation. We may observe further that these arteries come from the femoral by the external pudics, and from the internal pudic by the superficialis perinæi. It was for a long time supposed that the hæmorrhage which sometimes follows the puncture for hydrocele was derived from the opening of these branches; but, although such an oc-

currence is possible, we are well convinced, with Scarpa, that most frequently, perhaps always, this accident arises from pricking the spermatic artery. In all cases, unless these branches have acquired a magnitude of at least twice their natural volume, it is difficult to believe that they can furnish a formidable hæmorrhage.

X. *The Veins.*

In like manner with the arteries they run in the superficial layers, and even under the skin, where we not unfrequently see them become enlarged, tortuous, in short, varicose; their accidental dilatation is generally occasioned by the developement of tumours in the groin, such as buboes, scrofulous glands, crural hernia, &c.; because, forming the external pudics they empty into the saphena and must therefore participate in its pathological derangements: when they are immoderately dilated, in consequence of their volume and the disposition of the external cellular layer, the bites of leeches are usually followed by extensive ecchymoses; the extravasated fluid, however, is very rapidly absorbed.

XI. *The Lymphatics.*

These vessels form two sets; one for the envelopes, which passes to the groin; the other for the testicle, its immediate coverings and the cord, along which it takes its course into the abdomen. This distinction is of much more importance than might at first sight be imagined: for from it we may infer, *à priori*, that a great number of the diseases of the envelopes which enter into the formation of the scrotum, produce tumefaction of the glands in the inguinal region, whilst an acute or chronic disorganization of the testicle must re-act upon the whole length of the cord, into the lumbar region, behind the mesentery, etc. Thus erysipelas, *dartres*, other eruptions, and even the application of a blister upon the scrotum, frequently produce pain and tumefaction in the fold of the thigh, affections which never proceed from deep-seated cancerous diseases: and it is well known that in consequence of sarcocoele, or some time after its removal,

the lymphatic glands of the iliac fossa and loins, form a knotted chain extending from the testicle to the renal region.

XII. *The Nerves.*

The *Ilio-scrotal* nerve terminates by ramifying in the membranes exterior to the tunica vaginalis; it even extends into the subcutaneous layer; but the scrotum more especially derives its nerves from the internal pudic; therefore, an injury of this sac, particularly in its inferior half, will be attended with more acute pain towards the perineum than in the direction of the inguinal canals.

As it regards the extirpation of a cancerous testicle, the arrangement of the organs previously studied may be examined under three principal relations, that is to say, relatively to the division of the envelopes, to the dissection of the tumour, and lastly to the section and ligature of the cord.

1st. In making the incision for exposing the cancerous mass, we cannot and ought not stop to separate layer by layer the different tunics of the scrotum; for the disease sometimes obliges the surgeon to comprise a more or less extensive portion of all these membranes in an ellipsis, in order to remove them at the same time; for example, if ulcerations exist, or the skin is disorganised, adherent in any manner whatever, or if the tumour is of considerable volume; on the one hand, for the purpose of excising all the diseased parts; on the other, because the elasticity of the integuments being diminished in consequence of long continued distention, the skin will be redundant, and its edges will become inverted so as to retard the formation of the cicatrix. This phenomenon, which is very common, notwithstanding the precautions we take to avoid it by removing a considerable flap of the skin, may, we think, be easily accounted for. In fact, the integuments are very thin and supple; they do not possess the least power of contraction; on the contrary they are lined by several membranes in which elasticity is more evident, and among which there is one which enjoys all the properties appertaining to the muscular tissue; so that, after castration, it is plain that the lips of the wound will be puckered, drawn inwards and rolled upon their internal surface by the action of the fleshy tu-

me. It is in this first step of the operation that the superficial arteries derived from the external pudic are opened, and that it is proper to tie them.

2d. The dissection of the testicle necessarily presents greater or less difficulty according to the stage of the disease; but we should notice here that it approximates sufficiently near to the penis internally to require certain precautions in relation to the urethra. When adhesions do not exist, the dartos yields so much as to admit of a ready separation of the parts; but sometimes they are firmly adherent near the root of the corpus cavernosum. In all cases, we find towards this point one or more twigs of the internal pudic artery, which must be secured as soon as divided.

3d. This dissection being accomplished, if we pass a ligature formed of three or four threads around the cord, near the ring of the external oblique, and draw the noose very firmly, nothing will then remain but to divide the cord a few lines lower down, in order to terminate the operation. As by this method, which is decidedly the most simple, speedy, and perhaps the most safe, we tie at the same time the arteries, veins, vas deferens, nerves and the cellular tunic, reasoning induces us to infer that this ligature, unnecessarily applied upon the nerves, will be attended by unpleasant consequences, and from a case related by Morand, which is, indeed, by no means conclusive, it is supposed that this method will be liable to produce tetanus, or other more or less formidable nervous phenomena. Without denying the possibility of such occurrences, we can at least affirm that we have seen M. Gouraud, surgeon in chief of the general hospital of Tours, operate thus upwards of twenty times, without any serious consequences ever resulting from it. At the hospital of St. Louis, we have seen the same method always succeed with M. Riche-rand. At the hospital of the Faculty, M. Bougon never operates otherwise, and we have not observed nervous phenomena in a single instance. But in order that it may be successful, it is necessary to strangulate the part completely; for if we do not, the pain will be much more acute, because the nervous filaments might continue to act below the ligature; besides, by not drawing the thread sufficiently tight, vitality will be preserved in the free extremity of the cord, whereby it will soon become cov-

ered with cellular granulations, forming a species of fungus, or excrescence, capable of contracting adhesions with the circumference of the inguinal ring, as is recorded in a case by J. L. Petit, and as we ourselves have observed under MM. Richerand and J. Cloquet, at the Hospital of St. Louis.

If we act differently, we can only expect success by the isolated ligature; for by resting satisfied with rubbing the vessels between the fingers, according to Ledran's recommendation, we cannot reasonably consider ourselves safe against secondary hæmorrhage. The compression upon the cord by means of dossils of lint, or small compresses applied around it and upon the anterior part of the ring, would at least expose to all the accidents charged to the ligature *en masse*, without possessing its advantages. But this isolated ligature, whether we imitate Sabatier, or follow the advice of Dupuytren, or adopt the method of Delpech, is not more decidedly safe; the two principal arteries, it is true, are almost always easily seized; for being less retractile than the cellular tissue in which they are imbedded, it is not unusual to see them project a line beyond the divided extremity of the divided cord; but there are generally some secondary branches remaining which cannot at first be distinguished, and which afterwards occasion an extravasation in the inguinal canal, or even in the abdomen, or finally, a hæmorrhage externally.

But, let the plan which the surgeon may prefer in order to guard against hæmorrhage be what it may, the general method for the direction of the incision is the same with almost all; that is to say, we attack the disease upon its anterior part and slightly externally; in this case, however, it frequently happens that the pus stagnates at the bottom of the incision, and retards the cure, sometimes even favouring the formation of an abscess above or below the wound. It is with a view of avoiding these inconveniences, as well as to conceal an unseemly cicatrix, that Doctor Aumont always incised upon the posterior surface of the tumour, and operated in this direction exactly after the manner adopted by other practitioners in operating upon the anterior part. He also pretends that by this method, the lips of the wound are less disposed to become incurvated.

We can now comprehend that which concerns scrotal herniæ.

Whenever the viscera descend into the scrotum, the hernial sac gradually dilates the cellular tunic of the cord, which resists the displacement in a greater or less degree. When the hernia is still simply bubonocoele, the sac with its contained parts may be returned with facility, and the cord has as yet undergone no alteration; but when the tumour is large and of long standing, the vas deferens and spermatic vessels may have contracted entirely different relations. They separate, seem to expand into a cellular web, sometimes remain behind the tumour in this state, and are very distant from each other; at other times the artery or vas deferens is placed on the external, internal or anterior aspect of the hernia, as noticed by Ledran, or makes a spiral turn around it as observed by Fardeau.* In all these cases we conceive that, in order to avoid them with the greater certainty, the incision of the integuments and sac must be made upon the anterior and external surface, following the direction of the tumour, and that it would be dangerous, after the reduction of the viscera, to remove the sides of the hernial sac with the scissors, as was done by many surgeons of the last century.

The Cellular Tunic also establishes a remarkable difference between simple scrotal and congenital hernia. Indeed, as this tunic terminates with the entrance of the vessels into the testicle, it follows that the tumour also terminates at this point by a species of neck, or circular contraction, and that this organ, always separated from the hernia, is thrown upon one of the points of its posterior part; whilst in those cases in which the tunica vaginalis forms the hernial sac, the displaced parts descend much lower down, and are, as it were, mingled with the testicle. The relations of the peritoneal envelope with the surrounding layers, in these two forms of hernia, also lead to other important differences in surgical practice; thus the accidental sac, notwithstanding the long duration of the disease, is susceptible of re-entering the belly, or at least of being brought very near to the ring by folding upon itself, after the reduction has been accomplished; and for this reason, because when the viscera protrude through the ring, in order to descend along the cord, the cellular tissue as well as the cord itself elongate, and may in this manner be stretched very considerably; afterwards, when the viscera are

* Journal de Sedillot.

returned, the natural elasticity of the parts, released from the weight which distended them, gradually restores them to their primitive position, and the sac, at least in great part, if not entirely, slowly disappears. We see then, that it must be pretty often possible, in ordinary inguinal herniæ, to push back the serous tunic which immediately invests them, without the testicle being necessarily dragged along with it. In congenital hernia, on the contrary, the sac is fixed, it cannot ascend, and it is united in a much more solid manner to the constituent parts of the cord. Consequently, in this form, we should never attempt to return this pouch; and if we wished, after the manner of the ancients, to pass a thread around its neck for the purpose of obliterating it, so as to prevent a relapse, we would not fail to produce atrophy of the testicle, because the ligature will almost inevitably comprise the vas deferens. It is also well to note that this sac is generally a little thinner than the abdominal peritoneum, whereas in the other species of hernia it is thicker. Now, whether the hernia is congenital or otherwise, we will always be obliged to divide the same number of envelopes, which will be, 1st, the skin; 2d, the subcutaneous layer, in which the branches of the external and internal pudic arteries are situated; 3d, the fibrous tunic proceeding from the circumference of the ring; 4th, the cremaster muscle; 5th, the tunic derived from the *fasciæ transversalis et propria*, or the cellular sheath of the cord; 6th and last, the hernial sac, or the tunica vaginalis. If all these layers were perfectly distinct, if their thickness did not present infinite variations, it would never be difficult to arrive at the displaced viscera; but, most frequently, they are so blended with each other as not to admit of distinction; sometimes very thick, at other times extremely thin, their division demands the utmost precaution; but even if we should succeed in distinguishing in succession the superficial layer, the muscular layer, which is almost always possible by recollecting their anatomical characters, we would always be embarrassed in our endeavours to recognise the cellular sheet which surrounds the cord, the thickness of which varies exceedingly. When we have penetrated into the sac, the disposition of the parts also is far from being always the same; sometimes, indeed most frequently, the protruded viscera are separated from the parietes of the pouch which encloses them by a greater or less abundance of serosity, and in this case only

can the method of Louis, which consisted in penetrating into the hernial sac at the second stroke of the knife, be void of danger. At other times, on the contrary, the viscera are dry, and we may conceive how ridiculous the pretensions of the celebrated academician are in this respect, since the most minute attention does not always suffice in order to avoid the intestine; a recent proof of which was exhibited in one of the great hospitals of Paris.

Adhesions occasionally exist between the internal surface of the sac and the displaced parts; the epiploon, for example, may contract several forms of them, with which it is of importance to be acquainted. Thus, it may become united to the hernial sac, and form in its cavity a species of cord or transverse ligament fixed by its two extremities,* and if an enterocele exists at the same time, we conceive that the intestinal loop, being more or less girded by this band, may become strangulated within the sac, either in consequence of the accumulation of fæcal matters, or a sudden distention produced by the disengagement of gas, etc. In other circumstances, the epiploon, at first spread out as it enters the sac, to the neck of which it becomes agglutinated, is afterwards rolled into a cord, again becomes free as it descends, and then fixes itself to the fundus of this pouch; in this case the prolapsed portion of intestine is, as it were, divided into two segments; whence it follows that, in our attempts to reduce it, it frequently happens that as we push upon one side it comes down at the other; and the band itself may also occasion strangulation. We may read in Scarpa of other varieties of epiploic adhesions producing strangulation, and, among others, that which came under the observation of Doctor Volpi.

The intestines themselves frequently become agglutinated to the peritoneal sac, and the adhesions may then be referred to three species: they are either recent, and only exist through the interposition of an albuminous layer imperfectly organized, and do not oppose the reduction; or they are of long standing and form bands or filaments, which vary in length and number; so that, in the first place, they render the reduction of the viscera impossible without the return of the sac, and if we do not divide them, notwithstanding the reduction and the success of the operation, the patient will continue to suffer from colicky pains; if the hernia is congenital, and a similar band, appertaining to the intestine

* Arnaud, Scarpa.

or epiploon, is attached to the testicle, as was apparently the case in the learned Zimmerman, we may easily imagine all the dangers to which the patient will be exposed; or finally, they are intimate and of long standing, so that every attempt to separate the intestines or omentum from the sac would be dangerous. It is in this case that we are obliged to imitate Petit, and leave the parts as they are, after having dilated the stricture sufficiently.

The viscera themselves present a disposition in herniæ which merits attention. When the small intestine is met with in the same sac with the epiploon, the latter usually envelopes the former like a hood; so that this hood may become lacerated and give passage to a portion of the intestinnal loop through the aperture, the margins of which frequently become sufficiently indurated to produce strangulation, as was observed by Baudelocque in the umbilical hernia of a pregnant woman. The digestive tube itself is, in some cases, so twisted and entangled as to occasion a complete strangulation. In herniæ of the cæcum, the loose extremity of its vermiforme appendage sometimes becomes agglutinated to a point of the cavity or neck of the sac; and, if the intestine should be displaced in its turn, this disposition will form an additional cause of strangulation: the mesenteric fold of this appendix may also become lacerated, and, like the omentum, allow a knuckle of the intestine to slip through it.

With respect to the cæcum, its relations with the peritoneum in the fossa iliaca are remarkable, as we have already noticed, inasmuch as this membrane permits it to pass through the inguinal canal without being obliged, necessarily, to draw with it a complete sac. In fact, pressed by the weight of the fæcal matters and the action of the muscles, the neck of the sac, being connected to the fascia iliaca by a very extensible cellular layer only, gradually turns back as it is traversing the inguinal canal, so that when it has got into the scrotum its posterior face is more or less raised, and sometimes corresponds to the two external posterior and inferior thirds of the tumour, of which the superior and anterior portion only is free in a peritoneal sac.* In this case, the hernia demands

* Probably this descent of the cæcum would be more clearly illustrated by comparing it with the descent of the testicle in the fœtus, to which its mechanism bears a pretty exact resemblance. *Transl.*

precautions under two different points of view : in the first place, it can only be incised upon its anterior and internal side, so as to fall upon the sac and be able to relieve the strangulation ; in the next place, the immediate reduction is almost always impossible because the cellular layer, drawn from the iliac fossa into the sheath of the cord, unites the greater portion of the intestine to the internal surface of this sheath, constituting what Scarpa calls the “*natural fleshy adhesion*.” Moreover, this is a peculiarity which is also sometimes observed in the hernia which is formed by the sigmoid flexure of the colon, and almost always in that of the bladder, which are explained in a similar manner. We may also observe that the cœcum is disposed in such a manner that it might be destroyed by gangrene, without an artificial anus necessarily resulting from it. Indeed, should all that portion of the large intestine, which is inferior to the termination of the ileon, be destroyed in a hernial sac, the fæces would pass directly from the small intestine into the right colon, because the cœcum is, ultimately, only a cul-de-sac, which nature might possibly do very well without ; the posterior surface of the ring will contract adhesions with the perforation of the destroyed organ, and the cicatrization will not present any thing very extraordinary.*

In all these tumours the decomposed spermatic cord is more or less elongated and scattered ; but, after the cure, if the disease has not been of very long continuance, it gradually resumes its natural dimensions. If a hydrocele of the tunica vaginalis exists at the same time with a scrotal hernia, the hernial sac always touches the cyst which is filled with the fluid, at its superior, or some other point of its circumference, and the two pouches are separated by the tunica propria of the cord only, that is to say, by the cellular layer ; so that, if the testicular membrane should give way, the hernia, with a part of its sac, will pass through the rent, or, if the latter is at the same time comprised in the rupture, the viscera alone will penetrate into the tunica vaginalis and strangulation possibly ensue. M. Dupuytren seems to have met with several cases of this nature.†

* Bent, *Med. Obs. and Inquiries*, vol. iii. page 64. See also Scarpa, page 189 and plate ix. fig. 4.

† Sabatier, *Med. op.* tome 3, page 24.

In epiplocele with adhesions or gangrene, the reduction should not be attempted, and the reason why it should not may be readily apprehended. In the first case, we should content ourselves with excising the part which is free in the sac, and afterwards treat the disease as a simple wound. In the second, if we cut into the living part for the purpose of removing the gangrened portion, and afterwards reduce the epiploon, the arteries of this membrane are so large that they will give rise to a mortal hæmorrhage. If we tie it, in order to strangulate the part and cause it to drop off by mortification, such serious nervous symptoms have frequently resulted from this procedure, that surgeons generally have abandoned it. The anatomical disposition indicates that it is much better to tie the principal arteries separately, and leave in the mouth of the sac the divided extremity of this membrane; by so doing, all that we have to dread is occasional traction of the digestive organs, after the cicatrization is completed.

When the intestine has been for a long time pressed against the ring, or any other narrow aperture, it sometimes contracts to such a degree that the fæces can no longer pass through it; indeed, a species of neck or constriction is formed in it, which is the more dangerous because it is not generally suspected, and after the reduction, instead of the symptoms being relieved, they only become aggravated until death. The mere possibility of such a state should suffice to induce surgeons always to draw down a portion of the sound intestine previous to attempting the reduction. In the *Memoirs of the Academy of Surgery* we will find a case of this nature recorded by Ritch. If it should be discovered in season, the only resource will be to establish an artificial anus, or to attempt *Invagination* after having removed the constricted portion. With respect to this invagination, which consists either in the introduction of a piece of the trachea of an animal into the two divided extremities of the intestine, which we re-unite upon it by means of a few points of suture, if we adopt the method of the four masters, revived by Duverger; or, by substituting a cylinder of a playing card for the trachea, as recommended by Ritch and Sabatier; or, by the simple introduction of the superior into the inferior portion and retaining them by ligatures, as was done by Ramdhor; or, what is still better,

by introducing the ventricular portion of the intestine into the cæcal portion, after having previously inverted the latter upon itself, in order that the serous membrane of the two invaginated extremities may be in contact, a method successfully employed by M. Jobert* upon many animals. It should be noticed that, in making the excision of the intestinal portion which we are obliged to remove, we must necessarily take away also a triangular flap of the mesentery, and even detach this duplicature, to a certain extent, from the concave margin of the intestine, in order that we may introduce one portion of the canal freely into the other. Now at this step, there will be several accidents to avoid, as well as pretty great difficulties to encounter. In the first place, we divide the mesentery in a point where the arteries are very numerous and all of which have a certain volume: when we separate the mesenteric fold from the ends of the intestine, in order to invaginate them, we must necessarily cut many of these branches, which may require ten, fifteen, or twenty ligatures; for, if we neglect to apply them wherever they are necessary, although the arterial mouths may be shut for an instant, they will not fail to re-open after a little, and give rise to mortal hæmorrhage. Furthermore, it is not so easy a matter to invaginate two portions of intestine as we might imagine, from reading the description of this process as given by authors. The inferior extremity of the divided intestine, being no longer distended by the passage of the fæces, contracts and closes to such a degree that its canal almost entirely disappears; it is sufficient, however, in order to have an idea of the obstacles which then present themselves to glance at the cases related by M. Boyer in his *Traité des maladies Chirurgicales*.† We ourselves have seen, at the hospital of St. Louis, a woman from whom M. Richerand was obliged to remove more than six inches of the small intestine, on account of a contraction, or rather an almost complete obliteration of the kind just mentioned. The ligature of the numerous divided arteries was accomplished with facility; but when

* This young surgeon, who has recently been appointed adjunct professor of anatomy to the Faculty, has made, since the reading of his memoir to the academy in 1823, some very interesting researches relative to this point of doctrine; but as they form the subject of a work which he is about to publish, we will decline speaking of them in this place. † Tome, viii.

M. Richerand came to distend the cœcal portion of the ileon, in order to introduce the other within it, he was astonished at the degree of contraction which had taken place in the space of a few minutes, and the small volume to which it was reduced ; it was necessary to irritate it a long time, to draw it in opposite directions with the forceps, and it was only after repeated unsuccessful attempts that he finally effected the invagination. This, however, did not prevent the patient from dying forty-eight hours afterwards ; but her pelvis was found to contain a great number of scirrhi or cancers.

When we do not wish to attempt the invagination, the only resource which remains is an artificial anus ; that is, the two ends of the intestine being allowed to remain in the external wound, through which the fœcal matters make their escape. This result is observed in consequence of gangrene, especially from strangulated hernia. It was for a long time supposed that this infirmity was beyond the resources of nature and art ; but fortunately anatomy and modern surgeons have proved the contrary. Scarpa has demonstrated by observations derived from man, and Travers, from experiments made on living animals, that in the artificial anus the two ends of the intestine open into the wound, forming together a more or less acute angle, in the sinus of which the mesentery is situated ; that the circumference of their opening is united to the abdominal periphery of the neck of the sac, and consequently that their concave surfaces are applied together to an extent proportionate to the loss of substance. In other words, if we examine the bottom of the wound we will find two openings which pass together backwards, one above, the other below, and that this double orifice is separated by an angle, a septum, or a species of spur which advances more or less towards the exterior ; that these parts are afterwards removed from the ring by the tonic action of the tissues drawing with them the remnant of the hernial sac, which soon forms a species of membranous funnel, the wide portion of which embraces the circumference of the ends of the intestine, whilst its narrow part remains in the wound ; finally, they have proved that, in cases where the re-establishment of the course of the fœcal matters is accomplished, they never pass directly from the superior extremity into the inferior : that, on the contrary, they were al-

ways poured by the former into the membranous funnel before entering into the second, if they did not escape directly through the wound. Consequently, the larger or wider this infundibuliforme space is, and the shorter the septum or spur which tends to divide it into two parts, the greater will be the facility of re-establishing the functions of the intestinal canal; for, it is evident that the greatest obstacle to the cure is precisely this middle septum which unites the two extremities of the intestine doubled upon their concave margin, since without it, the fecal matters would fall almost directly from the superior part into the inferior. Now, Desault had already derived some success by repelling this septum backwards, by means of a tent or a dossil of lint introduced each day into the bottom of the wound; and Smakalden had proposed a more speedy method, that of perforating this partition, when M. Dupuytren, in France, invented a very ingenious process for destroying it, without incurring the risk of producing an extravasation into the peritoneum. In fact, the species of dressing forceps with blunt teeth, which the latter author employs for seizing this membranous angle to the depth of an inch or an inch and a half, possesses the great advantage of producing an adhesion of the parts surrounding the portion included in the gripe of the instrument before it is completely mortified; so that, by its means we obtain an extensive perforation, which is not attended with the same dangers to the patient as those which would follow the simple section produced by a thread passed through the base of the septum, for the purpose of dividing it from behind forwards, as was first suggested by the same professor, or with the scissors, after having introduced a thread in the same manner, as advised by Physick, of Philadelphia.

From what has preceded, we will perceive that the precaution recommended by Lapeyronnie in order to prevent the intestine from re-entering the abdomen after a portion of it has been removed in consequence of gangrene, and which consisted in passing a loop of thread through the mesentery, is rather dangerous than useful. In fact it would oppose the formation of the membranous funnel by preventing the retraction of the divided intestine, and it is never necessary, since the parts have already contracted adhesions, when the operation for hernia is rendered ne-

cessary, so solid that we need not have any apprehensions on this score.*

Be this as it may, the tendency which the stercoraceous fistula will have to re-produce itself, after the cure, will be proportionate to the size of the elbow formed by the intestine. For example, in spontaneous cures, or in those obtained by the simple means employed by Desault, the angle being merely blunted, without having lost any proportion of its absolute length, the course of the fæces is always difficult, accompanied with colics, and the relapse is always to be apprehended if the patient does not use every precaution which his state demands. By the method of M. Dupuytren, on the contrary, when successful, the membranous septum being destroyed, the fæces are no longer obliged to form an angle in their course, but follow almost their natural direction, and the subjects are less tormented with intestinal pains. For a more minute consideration of this subject we refer to the modern treatises on surgical pathology.

The order of superposition of the parts contained in the scrotum having been already indicated several times, when describing it layer by layer, or when speaking of the operation for hernia, we will not again recur to it at present. We will only remark previous to concluding this section, that the superficial arteries, naturally very small, sometimes become greatly enlarged when the scrotum is the seat of voluminous tumours. The same may be said of the cutaneous veins, which also frequently become varicose, even when the other tissues are in a sound state; they then constitute the affection called "*cirsocele*."

Sect. 2. Ano-Perineal Region.

This region is bounded anteriorly by the root of the scrotum; posteriorly, by the apex of the coccyx, and laterally, by the tuberosities of the ischia; it is of an oval form, its largest extremity situated posteriorly, and comprises all those parts which are included in the circle of the inferior strait of the pelvis.

Its surface presents, anteriorly and upon the median line, an

* We here speak of hernia with gangrene, for we do not pretend that adhesions necessarily exist in other cases requiring operation.

elongated prominence which corresponds to the canal of the urethra, in the middle of which is the raphé; behind this prominence the opening of the rectum, and more posteriorly the coccygeal eminence. Upon the sides of the urethral prominence we find two deep furrows, bounded externally by the inner and posterior part of the thigh and buttock, in the bottom of which it is always possible to feel the ascending ramus of the ischium and the descending of the pubis. As to the anus, it is found at the bottom of an excavation limited by the buttocks and the ischiatic tuberosities. If we draw a line transversely, from one tuber ischii to the other, we separate what is properly called the perineal region from the anal region; and thereby constitute an anterior triangle, the base of which is formed by this line, whilst its apex corresponds to the superior part of the arch of the pubis. As the sides of this triangle are slightly convex, it follows that its apex appears narrow and elongated. Their length is about three inches and a half, whilst the base is usually only three inches. If we drop another line from the summit of this space to the fore part of the anus, we will equally find three inches. The perinæum then presents two triangles which are perfectly similar, and it is by one of these triangles that the instrument must necessarily penetrate in order to arrive at the bladder, in the lateralized operation of lithotomy. In order to distinguish these different features, the thighs must be widely separated and flexed upon the pelvis; for, otherwise, there only exists between the thighs a simple groove, in the bottom of which is found the anal aperture and the root of the scrotum and of the penis; so that in the fœtus, during labour, for example, this groove is transformed into a fissure so narrow, by the pressure which the breech experiences in passing through the superior strait, that many accoucheurs have been deceived by it, mistaking it for the sagittal suture.

CONSTITUENT PARTS.

1. *The Skin.*

The characters of this membrane are compound: anteriorly, it presents those of the skin of the scrotum; laterally and poste-

riorly, it grows thicker by degrees, and is continuous with that of the thigh and breech; as it approximates the anus especially, it becomes extremely thin, and is covered with wrinkles, which have this opening for their centre; in man it is shaded by numerous hairs, which sometimes become so matted together by the excrement as to occasion considerable distress during the act of voiding it: so that people are induced now and then to clip them off close to the integuments, which produces very acute pain for some days, in the same manner as was described when speaking of the inguino-pubic furrow. The follicles of this skin are less prominent but more numerous than those of the scrotum, and still more so as they approximate the rectum. The secretion of these follicles is very abundant, and gives to the skin of the perinæum an oily appearance. As this unctuous matter is mingled with the stercoraceous humidities, it becomes sufficiently acrid in certain persons to produce excoriations around the anus, especially in the bottom of the folds which converge towards this orifice; excoriations, frequently very painful, at least during defecation, and which are cured by touching them with the nitrate of silver. Finally, taken in its *ensemble*, this membrane is delicate, supple, extensible, and of a more or less deep brown colour.

II. *The Subcutaneous Layer.*

In the perineal portion, this layer is lamellated, thin and destitute of adipose cells; upon the median line, that is to say, upon the urethra, it possesses a great degree of mobility and is evidently only a prolongation of the fascia superficialis or cellular layer of the scrotum, with which it is continuous without interruption: whence it follows that the skin of the perinæum may be drawn very far in every direction, and that urinary, purulent, or other infiltrations are formed with the greatest facility in the scrotum, notwithstanding the affection may be situated quite at the posterior part of the region; this is what occasionally happens, for example, after the operation for the stone, especially when the incision of the skin is prolonged very much forwards; hence urinary infiltrations were one of the principal inconveniences resulting from the operation of lithotomy as performed by Giovanni di Romani. Laterally, but still in the perineal

region, this layer is thicker and less regular; it is then no longer simply lamellated; numerous very strong filaments intersecting each other in various directions are there met with, as well as adipose cells; so that its texture is much more compact and forms a species of elastic cushion, which varies very much in thickness in different subjects.

In the anal region and upon the median line, it is always very thin, and even scarcely exists between the sphincter of the anus and the integuments; so that the fleshy fibres are in immediate contact with the skin; hence phlegmonous abscesses cannot be developed in it, or, at least, if suppuration should take place here, it will only produce very circumscribed and small tubercles; whereas, in the preceding points, very extensive abscesses may manifest themselves, susceptible of spreading rapidly and to a great distance.

Laterally, it forms a very considerable mass which is continuous with the subcutaneous cellulo-adipose layer of the breech, passes before the glutæus maximus, and fills that large triangular excavation which we will soon see between the two fibrous sheets which cover the external aspect of the levator ani muscle, on the one part, and separate the obturator internus from the perinæum, on the other. It is here particularly that this layer includes fat with soft and sometimes reddish cells; that its lamellæ and its filaments are intermingled in every possible direction, so that it presents much elasticity; its constituent parts, especially the filamentous portions, are so intimately blended with the perineal aponeurosis, that they seem to be only a rarefaction of it. Be this as it may, it is in this that phlegmonous abscesses around the anus are developed, and also stercoraceous abscesses which precede the formation of fistulæ: finally, in the lateralized, transversal and lateral operations for the stone and all their modifications, it is the usual seat of urinary depots and infiltrations of the same nature. Furthermore, it is also continuous from one side to the other, by passing between the rectum, the coccyx, and the posterior prolongation of the sphincter ani muscle, on the one part, and between the anterior prolongation of the transversalis perinæi muscle, the bulb, the membranous portion of the urethra and the anterior part of the rectum on the other; so that the products of suppuration on the right side may pass to the left with great facility.

III. *The Aponeurosis.*

This lamina was described by Camper and some other anatomists of the last century; but Colles* gave a much more correct description of it in 1811; as well as MM. Carcassonne† and Bouvier,‡ who have recently made it the subject of interesting investigations. It is very complicated, and in order that its description may be comprehended, it is necessary that it should be studied upon the dead subject. We will describe it first in the anal region, afterwards in the perinæum, properly so called.

In the first portion it consists of two laminæ; one of which is applied upon the external surface of the levator ani muscle, and consequently passes, anteriorly, to the posterior part of the transversalis perinæi muscle; posteriorly, to the fore part of the coccyx, and inferiorly to the sphincter, where its outer surface becomes rarefied and is lost in the subcutaneous layer. The other, which lines the perineal surface of the obturator internus muscle, is continuous inferiorly with the internal margin of the ligamentum sacro-ischiaticum magnum and its productio falciformis; anteriorly, superiorly and posteriorly it goes to connect itself with the preceding lamina; so that they leave between them an interval, a very remarkable triangular space, of which they constitute the two sides, by forming two inclined planes, one from below upwards and from without inwards; the other from below upwards also, but from within outwards: or rather, that these two laminæ commencing from the deep seated sheet of the pelvic aponeurosis, by the unfolding of which sheet they are actually constituted, one of them descends obliquely outwards to the ischion and sacro-sciatic ligament, whilst the other passes downwards and upon the contour of the anus. Posteriorly, this space terminates by a *cul-de-sac*, which is limited externally by the external lamina just mentioned; internally, by the internal lamina applied upon the coccygeus muscle, and inferiorly, by the glutæus maximus, to the fore part of which the two preceding laminæ send a fibrous layer which curves over its inferior border and is afterwards spread out upon its external surface.

* Op.cit. pages 146, 156.

† Thèse Montpellier 1821.

‡ Thèse Paris, 1823.

Anteriorly, we find another *cul-de-sac*, bounded laterally by the same two laminæ, and by the superior surface of the transversalis perinæi muscle inferiorly; thus there are two depressions lined by the aponeurosis, and the whole of this excavation, which we call *ischio-rectal*, is uniformly filled with fatty cellular tissue. Measured from one paries to the other, inferiorly, its greatest breadth is about one inch or sixteen lines; from the summit of one *cul-de-sac* to the other, in the direction of the bottom or groove of the space, we find one inch and a half or two inches. The external fibrous or *ischiatric* layer is strong; its fibres fall perpendicularly upon the margin of the ligament; about twelve or sixteen lines behind the transversalis perinæi muscle, the inferior hæmorrhoidal artery and a branch of the internal pudic nerve pierce it obliquely inwards, and slightly forwards: it is in the lamellæ of its external surface that the internal pudic artery runs. The internal or *rectal* sheet is much thinner, its fibres are interlaced; it is rather cellular than fibrous, and its external surface seems to be unravelled or rarefied, in order to furnish the greater proportion of the cellular filaments intermingled with the fat, vessels and lamellæ which completely fill this excavation. It is needless to say that the inferior borders of the aponeurosis in question has no well defined limits; that, on the contrary, its external lamina becomes attenuated, in order to blend itself with that of the thigh and breech, and that its internal lamina is decomposed, as it were, in order to produce the subcutaneous layer, or at least to confound itself with it.

If we now follow this aponeurosis in the perineal region, commencing with it in the anterior *cul-de-sac* of the *ischio-rectal* excavation, we will easily recognize in it two laminæ also, which, however, are placed horizontally. The first curves directly downwards upon the posterior border of the transversalis perinæi muscle, and is then spread over its inferior surface, as well as that of the erector penis and accelerator urinæ muscles, and also lines the bottom of the space which separates them; it extends under the corpora cavernosa and urethra, and becomes blended with their fibrous envelopes. Consequently, this lamina represents a thin membrane expanded upon the inferior aspect of the muscles of the perinæum, of the bulb of the urethra, of the root of the corpora cavernosa, and which is attached by its sides to

the ascending ramus of the ischium and the descending of the pubis, whilst anteriorly, it is insensibly lost upon the body of the penis, and is continuous posteriorly with the two sheets of the anal portion of the region. After having given off this superficial lamina, the aponeurosis continues to proceed forwards, above the transversalis perinæi, erector penis and accelerator urinæ muscles, the bulb of the urethra and corpora cavernosa, as far as the summit of the pubic arch, where it is blended with the concave margin of the sub-pubic ligament, or triangular ligament of the pubis, from which it seems to derive its origin. It would perhaps be more exact to say that it then splits, in order to become continuous, anteriorly and posteriorly, with the fibrous layers which immediately envelope the bones and the symphysis. The layer which is attached to the internal labium of the arch of the pubis, and which it completely shuts up, is of a triangular form, and is perforated by the canal of the urethra, which it embraces anterior to the prostate, in the same manner that the aponeurosis of the posterior portion of this region is perforated by the anal extremity of the rectum: the deep or superior sheet, then, is only separated from the superficial lamina by the root of the corpora cavernosa, the bulbous portion and the anterior half of the membranous portion of the urethra, as well as the proper muscles of the perinæum; or rather, they all form but one layer here, between the sheets of which these several organs are developed. It is very irregular, of a yellowish elastic tissue; at the place where it is traversed by the canal of the urethra, anterior to the prostate gland, which it locks within the pelvis, it is continuous with the species of fibrous sheath which envelopes this body, and, more posteriorly, with the anal portion. This fascia, described by Colles under the name of *triangular ligament of the urethra*,* and by M. Carcassonne by that of *perineal ligament*, forms a septum which shuts, in its anterior half, the inferior strait of the pelvis, and in such a manner, that pus and other fluids accumulated in this cavity, do not enter the perinæum by the cellular trains, so common in other regions. As it more especially continues the external lamina of the *ischio-rectal* aponeurosis, the superior branch of the pudic artery also takes its course in

* Page 156.

the interval of its laminæ ; it appears to be particularly destined to support the commencement of the urethra in its proper position, and to resist the pressure which the viscera experience from the action of the diaphragm and abdominal muscles ; the rectum is chiefly supported by the posterior portion, which is so strong in some subjects as to oppose the introduction of the hand into this intestine. Finally, this lamina is also separated from the superior sheet of the pelvic aponeurosis, by the prostate, by that portion of the urethra and neck of the bladder which is enclosed in this gland, by the levator ani, and anteriorly, by some cellular tissue and vessels ; so that, in the perineal lithotomy, it is between these two laminæ in particular that we must attack the urethra and the neck of the bladder.

We may now readily comprehend some of the phenomena which accompany or follow fistula in ano, and several of the accidents attendant upon the operation for stone. Thus, when the cellulo adipose tissue which fills the *ischio-rectal* excavation is attacked with acute phlegmonous inflammation, an extensive abscess will form, which will have no other limits than those of this excavation ; when this abscess is evacuated, even should it be laid open throughout its whole extent, it will cicatrize with great difficulty, because its external wall is immoveable, whilst the internal approximates and recedes from it alternately, according to the state of plenitude or vacuity of the rectum, so that they cannot be maintained in contact. Hence it follows that incomplete external fistulæ are truly possible, that they even exist pretty frequently, but that they will generally exact the same treatment as complete fistulæ, notwithstanding many of them if left to themselves, as was the practice of Foubert, might get well spontaneously. It will readily be perceived that, in gangrenous or stercoraceous abscesses the difference is merely owing to the cause proceeding from the rectum, and especially to the nature of this cause, which occasions a much more rapid and extensive disorganization ; hence we conceive in either case, notwithstanding the incision of the intestine, that, if the cellular tissue is destroyed, if the suppuration has continued so long that the ischio-rectal excavation is no longer a simple possible cavity, but an extensive cavern, which is prolonged backwards to the fore part of the coccyx and glutæus maximus muscle. we conceive, we say, that the cure will be very

difficult, nay impossible, if we do not succeed, by some means or another, in effecting the reproduction of the adipo-cellular tissue in the vicinity of the anus. In order to favour this object it will be proper to advise the patient, as is the custom with M. Riche-rand, to go into the country and live upon succulent aliments, which furnish but little fæces. It may also be said that the methods by simple incision, by excision even, as recommended by Celsus, by cauterization and by the ligature are far from always preventing this destruction, and that the only means, which uniformly produces a radical and perfect cure, consists in laying open the whole extent of the cavity and removing the skin which has been excavated. This is the method adopted by MM. Boyer and Roux, and observation has proved that fistula in ano is more certainly cured at *la Charité* than elsewhere. We must not infer, however, that all fistulæ in ano necessarily require this plan of treatment; on the contrary, it is certain that a great number of them are cured by incision and also by ligature; but, in such cases the skin is not undermined, neither has the surrounding cellular tissue been destroyed by suppuration.

In the lateral operation for Lithotomy according to the processes of Ledran, Foubert and Thomas; or the Lateralized method in whatever manner it may be performed; if the incision of the integuments is not carried to a sufficient extent backwards, the urine infiltrates into the *ischio-rectal* excavation, and frequently produces dangerous inflammations, which are so much the more serious because the suppuration, extending from the deep-seated parts towards the skin, condenses the cellular layer by compressing its laminæ, as if it were in order to close the excavation inferiorly; so that it is generally very difficult to detect the fluctuation. In short, the anatomical disposition of the cellular layer, relatively to the aponeurosis, indicates that deep and extensive incisions must be early performed whenever a morbid fluid is disposed to collect in it.

IV. *The Muscles.*

(a) The *External Sphincter* of the Anus is the most superficial of all; sometimes very thick, at other times scarcely distinct, it is always fixed by means of a fibrous prolongaion to the apex of

the coccyx, posteriorly: anteriorly, it is gradually attenuated, its fibres become pale and are prolonged between the skin and the accelerator urinæ muscle, with the posterior extremity of which they contract intimate relations, and are finally lost in the *fascia superficialis* under the urethra. More frequently, the sphincter ani muscle terminates on a level with the sub-urethral fibrous lamina, in blending itself in a more or less complete manner with the fleshy bundle which covers the bulb; but we have several times seen it extend very distinctly into the sub-cutaneous layer as far as the root of the scrotum, and become continuous with the dartos. By attentively dissecting the sphincter of the anus, we will see that it consists of two orders of fibres; one forming complete and regular circles, which are immediately applied upon the external surface of the intestine and the integuments which dip into the cavity of this tube; the fibres of the other uniting together anteriorly and posteriorly at an acute angle, and separating in the middle of their length into two fasciculi for the aperture of the rectum. The former appear to be merely a continuation of the fleshy tunic of this intestine, and are of themselves capable of closing its aperture completely, and of producing those concentric wrinkles of the skin which dips into it, still preserving the annular form of this orifice; the second form the sphincter properly so called, and can only circumscribe an elliptical opening; they would reduce the anus to a fissure, more or less elongated, if their action was not combined with that of the circular fibres. This muscle is susceptible of very singular permanent spasmodic contractions, which did not attract the attention of surgeons until M. Boyer published his researches in the *Journal Complementary des Sc. Méd.* and more recently in his *Traité des Maladies Chirurgicales*; contractions which seem to be almost uniformly produced by excoriations or fissures in the cutaneous wrinkles; fissures pointed out by Avicenna, described with considerable exactness by Lemonier, in 1660, and also noticed by Sabatier; but neglected by all other authors. When this contraction arises from simple excoriation, a solution of the nitrate of silver is sufficient for its removal; in the other cases, one or more incisions of the muscle are the only means which have hitherto been attended with constant success; finally, it is

this affection which is described by Boyer under the title of *fissures*.

It would at first sight appear that the division of the sphincter in this case, and especially in the operation for fistula, as well as in the recto-vesical lithotomy, must necessarily be followed by an incapability of retaining the fæces; but this is not confirmed by experience, and the organ does not cease to perform its function at all, or soon resumes it after these operations.

(*b*) The *bulbo-cavernosus* (accelerator urinæ) muscle embraces the whole of the bulb and a part of the corpus spongiosum urethræ. As its fibres derive their fixed point from the groove which separates this canal from the corpus cavernosum, on the one hand, and on the other from the fore part of the rectum, it follows that it must flatten the urethra during its contractions, and thereby either retain the urine or propel it forwards according to the progress it has made in this canal. Many practical facts lead to the belief that it may also contract spasmodically during the introduction of the catheter, and for a moment oppose the passage of this instrument; and we may infer that this is the case when the catheter is stopped, for an instant, by an invincible obstacle, but in a few minutes later passes on with the greatest facility. It is, moreover, prolonged, as we have just stated, to near the anterior surface of the rectum, above the sphincter, where it becomes irregular and is lost, as it were, in the fibro-cellular tissue which exists between the membranous portion of the urethra and the intestine. In the Lithotomy by the method of Mariano Santo, this muscle is usually divided upon the median line into two equal parts; and, as its fibres are directed obliquely outwards, they will then draw asunder the lips of the wounded bulb and urethra, and thereby favour the formation of urinary fistulæ. In the *lateralized* operation for the stone, this muscle is divided on one side only, and parallel to the direction of its fibres: in the lateral method, according to Foubert, it is avoided and by following the plan of Celsus, we completely cut across its posterior portion. The latter operation was well comprehended by Bromfield, afterwards by MM. Chaussier and Morland, in 1805; by Bécларd in 1813; by M. Delpech of Montpellier in 1825, and, in the same year, successfully put in practice upon the living subject by M.

Dupuytren. If we follow the advice of M. Sanson, we will divide the posterior fourth part of this muscle only, upon the median line. Finally, it is separated from the skin by the superficial lamina of the perineal fascia and the subcutaneous layers only; and the canal of the urethra alone prevents its being applied upon the deep sheet of the same fascia, to which it attaches itself, however, by the external extremity of its fibres.

(c) The *Ischio Cavernosus* (Erector Penis) muscle embraces the roots of the corpora cavernosa in the same manner as that just described does the bulb of the urethra; equally in relation with the two laminae of the aponeurosis, it is separated from the accelerator urinae by a triangular space, the base of which is situated posteriorly, and in the bottom of which we see exposed the perineal ligament, that is to say, that in this point no organ intervenes between the two laminae of the aponeurosis, which are here united. It is not in this triangle merely, as has been too often repeated, that the incision in the lateralized lithotomy is made; the methods of Foubert, Ledran and Thomas in the lateral operation, require that it should be traversed, in order to reach the bladder. In fact, one of its sides, formed by the corpus cavernosum and the pubio-ischiatic ramus, is oblique from above downwards and from within outwards: the other, represented by the spongy and bulbous portions of the urethra, is parallel to the median line and does not extend quite to the anus. Now, in all the methods of the lateralized lithotomy, we endeavour to cut the urethra only between the bulb and the rectum, and that more or less obliquely outwards, from the termination of the membranous portion, anteriorly, to opposite the tuberosity of the ischion. Consequently, instead of following the middle line of this triangle, the instrument only crosses its base obliquely; and whenever it is passed into the urethra, for the purpose of extracting a calculus, let the modification of the method be what it may, the erector penis may and should be avoided.

(d) The *Transversalis perineæ* is situated at the bottom of this triangular space and constitutes its basis; it there forms a horizontal plane which originates from the inner labium of the ischium above the root of the corpus cavernosum, about one inch anterior to the tuber ischii, in order to pass to the median line, where it becomes blended with its fellow of the opposite side

and the root of the accelerator urinæ; indeed this species of intersection takes place above the cutaneous sphincter of the anus, between the bulb and rectum; it seems that it is placed in this situation in order to tighten and strengthen the perineal septum, between the laminæ of which we find it. Its fibres are strong, compact, and, as it were mingled with those of the aponeurosis, the two laminæ of which are very firm in this point; even so much so that the superficial layer of the fascia sometimes forms a very distinct band upon the posterior border and the inferior face of this muscle. According to this disposition, the transversalis perinæi muscle is always directed obliquely from before backwards and from within outwards towards its middle part, in the different methods of cutting for the stone below the pubis, even in the bilateral lithotomy; in fact, since the incision or the two incisions, always commence before these fleshy fasciculi, they they must necessarily be inclined more or less backwards, crossing more or less their fibres: we avoid them, however, in operating by the apparatus major, because the incision of the exterior soft parts stops at an inch before the anus.

(e) The *Levator Ani* and *Coccygeus* muscles. Their inferior portion alone enters into the ano-perineal region; their fibres descend obliquely from without inwards, so as to unite by a sort of raphé between the coccyx and rectum, above the posterior extremity of the sphincter, and anteriorly, between the same intestine and the urethra, above the transversalis perinæi, with which they are confounded. Thus re-united these muscles form a species of membrane, of fleshy pouch, perforated at its bottom by the rectum and lined on its outer surface by the internal lamina of the ischio-rectal aponeurosis. These are the muscles especially which close the pelvis in the anal portion of the perinæum, and constitute a complete muscular septum which antagonizes the efforts of the diaphragm and of the muscles of the belly; a septum, the contractions of which act upon the anus by an infinite number of radii, which tend to dilate by raising it, in such a manner as to counterbalance and even overcome the action of the sphincter ani; so that during defecation, at the same time that the levator muscles of the anus are rendered tense and contract, in order to resist the diaphragm which drives down the viscera, they also draw, more or less firmly, the perineal extremity

of the rectum from the centre to the circumference, by acting in an inverse direction to the sphincter, which then relaxes spontaneously or forcibly.

In the recto-vesical lithotomy, their anterior junction is constantly divided; in the other methods, they must always be avoided; sometimes, however the intestine is so voluminous and flaccid, that, by not taking the proper precaution to incline the bistoury or *lithotome* sufficiently outwards, we will not fail cutting them, and, what is still more serious, the intestine likewise. In the operation for fistula in ano they are incised at a greater or less elevation, but almost always parallel to the direction of their fibres; which is doubtless the reason why their action is not impaired, after the cure, from the solution of continuity which they have experienced. As it respects the internal surface and superior portion of these muscles, we will see them when we examine the cavity of the pelvis; we will merely observe here that we may incise them without fear of wounding the peritoneum, from the rectum towards the ischio-rectal excavation, as far as the groove which unites the two parietes of the latter; but, that higher than this, we would penetrate even into the cavity of the pelvis.

v. *The Arteries.*

The arteries must be minutely known, at least in their principal branches, if we wish to practice lithotomy with safety; they are all derived from the internal pudic, except those which the circumference of the rectum receives from the inferior mesenteric and from the hæmorrhoidals of the internal iliac. The latter will be examined with the intestine itself; at present, we will only attend to the former and its branches.

(a) The *Internal Pudic Artery* does not enter the perineal region until it is disengaged from the space which separates the two sacro-sciatic ligaments; there, it is included between the falci-forme process of the ligamentum sacro-ischiaticum majus and the ischiatic tuberosity; besides, the border of the glutæus maximus separates it from the integuments; so that it lies at a considerable depth. Nevertheless, Travers, surgeon of St. Thomas's Hospital in London, succeeded, as related by Dr. Harrisson, in

suspending a severe hæmorrhage, and which had resisted every other means, by compressing the internal pudic artery against the ischium or upon the ischiatic spine, and that by a very simple process, that is to say, by keeping the patient recumbent upon his back on a very hard bed ; or what is still better, by putting a piece of cork, of gum elastic, or graduated compresses of lint, etc between the coccyx and the tuber ischii. Strictly speaking, it would also be possible to apply a ligature around the artery at this point ; to accomplish which, it would be sufficient to make an incision through the skin and subcutaneous layer, commencing it above the base of the coccyx and terminating it upon the trochanter major ; afterwards separating the fibres of the glutæus maximus as far as the sacro-sciatic ligament ; then dividing transversely the inferior lip of the wound down to the same ligament, in order that the latter also may be cut, without being impeded by the muscular contractions. This fibrous band being divided, the ligature of the artery would no longer present any difficulty.

After the internal pudic artery has passed through this space, it continues to run along the internal face of the tuberosity and branch of the ischium : at first, it is simply applied upon the external face of the aponeurosis ; by degrees it becomes enveloped in its laminae, so that before it reaches the posterior margin of the transversalis muscle it is already imbedded in a complete fibrous canal. Whilst continuing its course above this fleshy plane and the root of the corpora cavernosa, always running along the arch of the pubis almost to its summit, this vessel gradually approximates the inferior surface of the deep-seated aponeurosis of the perineum, the superficial laminae of which nevertheless cover it until the moment when it divides into the dorsal and cavernous arteries of the penis. In this manner, the trunk of the internal pudic artery is firmly fixed by the aponeurosis throughout its whole course ; whence it follows that it is immoveable and does not change its position, either from the attitude of the subject or from the tractions which we exercise upon the perineum. On the inner side of the ischium, this artery is about twenty lines distant from the anus : but, it insensibly approximates the median line with the pubio-ischiatic rami, so that it is scarcely possible to wound it in lithotomy, unless we operate contrary to all the rules of art. In order to find it, inferiorly, we must seek for it at an inch above

the lower level of the ischion, and at its most superior part, it is still nearly half an inch above the level of the root of the corpus cavernosum; so that, upon the living body, it is very remote from the skin, and its depth shelters it completely from the action of the instrument, during the incision of the external soft parts. It should be noticed that its relations with the aponeurosis will render its ligature very difficult, if not impossible, if unfortunately it should be opened during the operation for the stone, and that the actual cautery would then be the only means which can promise any chance of success, because compression would not prevent the blood from being extravasated between the obturator internus muscle, or the levator ani and the aponeurosis.

The internal pudic artery here gives off three principal branches, which we must now examine.

(*b*) The first is the *external or inferior hæmorrhoidal*: this artery separates from the trunk and pierces the ischiatic lamina of the aponeurosis twelve or sixteen lines posterior to the transversalis muscle, consequently some lines before the internal pudic has applied itself upon the inner surface of the ischiatic tuberosity; having entered the *ischio-rectal excavation*, this branch passes transversely towards the anus, dividing several times in the cellular mass which fills this space. Its volume is so considerable, at its exit from the aponeurosis, as to give rise to apprehension from hæmorrhage, in case it should be wounded; but it will never be wounded in lithotomy by the lateral, lateralized or bilateral methods, unless the instrument is carried much farther behind the transverse line which separates the perinæum in the anal region, than is generally recommended. However, as it is not very deeply seated, and as its direction is slightly oblique forwards, we might wound it by carrying the incision too near the rectum, especially if we commence it only ten or twelve lines before the anus and extend it three or four inches, as recommended by Samuel Cooper, according to Hey, etc. Should this accident occur, however, the ligature of this artery would be much less difficult than that of the internal pudic, because it may be easily discovered in the cellulo-adipose layer which it traverses in its course to the circumference of the anus. Again, this artery is frequently divided in the operation for fistula in ano, especially when we adopt the method by excision, and it is this vessel

which produces the hæmorrhage which we then sometimes observe, but which is seldom serious and difficult to restrain, because the artery having already ramified for the distance of some lines, an inch even from the anal aperture, its several branches are of so small a calibre that the hæmorrhage will readily cease of itself or by simple compression. Sometimes, however, the hæmorrhoidal artery originates much further forwards, very near the transversalis perinæi muscle, in which case it will be difficult to avoid it in performing the operation of lithotomy.

(c) The second is the *arteria superficialis perinæi* (périnéale. *Ch.*); it is detached from the internal pudic about six lines only behind the transversalis perinæi muscle, under which it passes, winding in the subcutaneous layer, and diverging from two to three or four lines from the ischio-pubic ramus; in this manner it enters the external part of the *bulbo-ischiatic triangle*, follows the inner margin of the erector penis muscle, and, sending off ramifications, passes under the body of the penis and is lost in the septum of the dartos. At first this artery lies as deep as the hæmorrhoidal, but afterwards, as it enters the perinæum, properly so called, becomes very superficial, and more and more so as it approximates the scrotum. From its outer side, it gives off only one branch which is in the least remarkable, which crosses the root of the corpus cavernosum in its course to the inner part of the thigh. The branches which it distributes from its inner side are too small to merit much attention; nevertheless, it sometimes gives off the transversalis perinæi artery. So long as it occupies the situation just mentioned, it is easy to avoid in lithotomy; but we not unfrequently see it approximate much nearer to the median line, when it is not so readily avoided: it is the most voluminous of all those derived from the internal pudic, and it is generally from this that the most profuse hæmorrhages proceed which follow the operation for the extraction of calculi: thus it may be wounded by the lateral method, if, for fear of touching the rectum, we approximate too near the ischio-pubic ramus. So also in the transverse operation, if the incision is made too far before the rectum, or if we are obliged to extend the cut very far outwards. In the lateralized lithotomy, if the *lithotome* or bistoury, in being drawn out, or the gorget, in entering, deviate too much from the median line, we will frequently open

it, unless we adopt the method of Moreau or the modifications pointed out by M. Boyer; that is to say, in the first case, by acting in such a manner that the wound of the neck of the bladder and of the integuments shall be much more extensive than that of the intervening layers; and, in the second, by taking care, on withdrawing the *lithotome caché*, to allow it to close on withdrawing it, after the division of the prostate, in order to obtain the same result. But, and what is most to be apprehended, it may be divided in the first step of the operation: as it is, fortunately, however, always lodged between the aponeurosis and skin, and included in the superficial or subcutaneous layer, we may uniformly seize it without difficulty, in the posterior part of the external lip of the wound. As for the rest, the hæmorrhage will be more profuse the nearer the wound in the artery is to its origin, because this vessel, like all those of the perinæum, diminishes considerably in volume as it passes forwards and towards the median line. These are also two branches which it is necessary to tie in castration and amputation of the penis; sometimes even their twigs of termination are sufficiently large to exact a greater number of ligatures after these operations.

(*d*) Lastly, the third is the *Transversalis Perinæi* artery (uretro-bulbaire, *Ch.*) which is sometimes given off by the preceding, more frequently from the internal pudic; this branch almost always arises near the posterior margin and external extremity of the transversalis perinæi muscle; it immediately crosses this margin, but very obliquely, from its superior towards its inferior aspect and from without inwards, so that, deep-seated at its origin, it becomes superficial previous to its termination; its direction is transverse, or very slightly oblique forwards. Before this artery reaches the median line it divides into three principal branches, one of which passes before the anus and rectum; the other between the rectum and bulb of the urethra, and the third into the bulb itself; all anastomose with those of the opposite side, and thus form a very complicated and even exuberant network precisely in the situation which the knife must necessarily pass through in order to penetrate into or come out from the bladder, so that this plexus, which is always divided in these cases, almost always occasions a greater or less discharge of blood, in the different operations of lithotomy. In performing

this operation, the artery itself must also be divided, take what precautions we may, even in the bilateral method; because, in order to avoid the rectum, we always commence the incision very near the bulb, and because the edge of the instrument is afterwards always inclined more or less backwards, and not in a direction entirely transversal. Hence, the origin of the wound will be before the termination of the artery, whilst its posterior extremity will be behind this vessel; consequently it will always be divided at a greater or less distance from its origin, and the rules given for avoiding the transverse perineal artery are very certainly useless. If it so happens that it is not wounded, it is to chance or some peculiar anatomical disposition that we must attribute it; and if, moreover, lithotomy is not frequently followed by hæmorrhage, it is because the artery under consideration is not of so large a calibre but that the sanguineous discharge may cease spontaneously, and therefore does not require much attention. Finally, as it is situated between the two laminae of the perineal aponeurosis, it would not be very readily secured by ligature; but compression of it will not be attended with the same danger, as in those cases wherein it is supposed necessary to apply it upon the internal pudic. We may also make use of the actual cautery in the same manner as we would apply it to the latter vessel.

Strictly speaking, it is possible to avoid the transverse perineal artery in operating according to the bilateral method; this is even one of the advantages which have been correctly attributed to it; but in order to accomplish this object, the external incision must not be commenced at more than six lines before the anus; which incurs too great a risk of wounding the rectum, for the sole purpose of avoiding an artery of so little importance, the consequences of the division of which cannot be compared with those which would result from a wound of the intestine.

VI. *The Veins.*

There are two venæ comites to the trunk of the internal pudic artery as well as to each of its principal branches. In old men, and most calculous individuals, the veins are very large and form almost a plexus in the perineal region; besides, they follow.

in general, the course of the arteries and enter the pelvis by the ischiatic notch; there are also others which approximate the rectum and intersect each other between the muscular and mucous tunics of this intestine, forming a species of erectile network, in which hæmorrhoids are developed, and which we will have occasion to examine hereafter. Around the prostate we likewise find other numerous veins which equally form a plexus, which is sometimes so exuberant that the simple incision of this gland must be attended with a very profuse venous hæmorrhage;* so that when these different veins are varicose, which is not rare, they generally embarrass the surgeon greatly in operating upon the perinæum.

VII. *The Lymphatics.*

This system is of no importance in this region; the glands, if any, are not known, and the vessels pass to the groin or pelvis.

VIII. *The Nerves.*

The ischiatic branch of the small sciatic nerve and the internal pudic are the two most remarkable, and those which deserve some attention. The former, which makes a turn from the ischiatic notch upon the internal surface of the tuberosity of the ischium, is always included in the subcutaneous cellular layer, and is frequently comprised in the incision of the external soft parts in the transverse or lateralized operations of lithotomy. The second runs close by the side of the artery included in the same sheath; it divides like it and is distributed to the same parts; so that, when placing a ligature upon a divided branch of the vessel, it is sometimes difficult to avoid including the nerve, notwithstanding it is very necessary that we should avoid it.

IX. *The Urethra.*

This canal is about nine and a half inches in length and extends from the neck of the bladder to the extremity of the penis; according to Wathely and Ducamp it never exceeds this mea-

* Dupuytren, thèse de concours, 1812.

surement ; but we, as well as M. Lisfranc, have found it attain to eleven inches and three quarters. It is the most important organ of the perinæum, whether we consider it in relation to its functions in diseases, or on account of the frequent operations which we perform upon it ; therefore has it been, for a century at least, the object of a constant attention, and of extensive research. J. L. Petit first noticed that, in the state of *prolapsus* of the penis, the urethra presents a very distinct double curvature, and in consequence of this idea, which he greatly exaggerated, he gave to his catheter the form of the letter S. One of these curvatures, which is concave upwards, is met with under the symphysis of the pubis ; the other, which is concave downwards, exists before this articulation ; the latter disappears during erection, or when we exercise tractions upon the penis, whilst raising it towards the abdomen in a direction which seems to continue, forwards, that of the ischio-pubic branches ; and it is from this last circumstance, that some have, of late, endeavoured to maintain that the canal of the urethra is perfectly straight, or nearly so. Notwithstanding this assertion is far from being exact, M. Amussat has at least shown that we may, by drawing in a certain manner upon the penis, not only efface the anterior curvature, but also obliterate, in a great measure, that which is under the symphysis of the pubes, so as to enable us to introduce instruments, which are not curved, with facility into the bladder. Already had Licutaud, in his *Médecine Pratique*, M. de Montaigu, in his thesis of 1810, resolved this question by the affirmative, when Gruithuisen published in the *Saltzbourg Gazette*, of 1813, that straight sounds would easily penetrate into the urinary pouch, and that these sounds would permit the employment of different instruments for the purpose of breaking down calculi, or of decomposing them by galvanic currents. These facts, however, had fallen into oblivion, when in 1818 or 1820, and subsequently, MM. Amussat, Leroy (d'Étiolle), and Civiale resumed the question, *ab ovo*, and in such a manner that the former, by his researches upon the urethra and the straight sound ; the second, by his lithontriptic instruments, and the latter, by his brilliant operations upon the living subject, have succeeded in making this branch of practical surgery one of the most important and interesting of the present epoch.

But let us first examine the urethra in its four portions; after which we will resume the consideration of its direction.

1st. The *Prostatic portion* is from twelve to sixteen lines in length, and is found enveloped by the gland from which it derives its name, so that this is the proper place for examining the latter organ.

The *Prostate Gland* has the form of a cone flattened upon its posterior surface, the apex of which would look forwards: very small in children, it enlarges with age, and at from eighteen to twenty-five years its greatest breadth is two lines less than in the man of forty; in old men and in persons afflicted with diseases of the bladder, its volume is sometimes much greater; its dimensions must be studied with the greatest care, and the surgeon cannot be too familiar with them, when he wishes to perform lithotomy. Upon this subject we may consult the thesis of M. Senn*, the treatise of Scarpa on the lateral lithotomy, those of M. Amussat, etc.† From behind forwards, that is to say, from its base to its apex, its greatest diameter is sixteen lines; by measuring it at different heights and in the same direction, its length gradually diminishes, so that at its most superior part it is not more than four or five and a half lines; by cutting it perpendicularly near its base and transversely, we find that the largest section, through which the canal of the urethra passes, is thirteen or sometimes even sixteen lines from above downwards, and that the dimensions of those which follow gradually diminish to the apex. But it is important to remark that the circumference of this gland is not exactly circular, and that the urethra does not pass through its centre; so that, in order to have our measurements essentially surgical and practical, it is better to imitate M. Senn, and draw different radii from the canal of the urethra to the principal points of the circumference of the prostate: thus, the inferior radius will be six, seven, or eight and a half lines, very seldom more; directly across, we find nine and a half lines, and downwards and outwards, the direction in which the instrument must pass in the lateralized lithotomy, from ten and a half to twelve lines. The inferior or posterior surface of the prostate is its flattened portion; it rests upon the anterior face of

* Thèse sur diverses especes de tailles périnéales, Paris, 1825.

† Archives générales de Médecine, Janvier, Avril, 1824.

the rectum, as far as two inches and a half or three inches above the anus; it is separated from this intestine only by a thin layer of lamellated cellular tissue, in which fat is never deposited; so that it is very difficult to avoid wounding the rectum when the *lithotome* completely divides the posterior half of the prostate; and, if it is true that the section of the gland under consideration, should never be complete in the sub-pubic operation of lithotomy, if we wish to prevent serious consequences, it will follow that in cutting by the rectum we will not obtain, without danger, an opening so extensive as that by the lateralized or transverse methods. The pubic surface of the prostate is always from six to eight and a half lines distant from the symphysis; its lateral portions are separated from the ischio-pubic rami by a space of six to eight and a half lines, according as we examine it from the superior or its inferior part; which we may easily determine, by recollecting that the transverse dimensions of the gland in its broadest part, are from nineteen to twenty-one lines, and that in measuring transversely the arch of the pubes at the points which correspond to the superior, middle and inferior portions of the prostate, we find from twenty-one to twenty-three and a half, twenty-five and a half to twenty-six and a half, twenty-eight to thirty lines; so that this body is more approximated to the internal pudic artery the nearer we approach towards its superior portion. Between the symphysis, the rectum and the pudic artery, there are a great many other parts which more or less immediately surround the prostate; thus, it is enveloped by a more or less distinct layer of fleshy fibres running in a longitudinal direction, which are blended, as it were, with its proper tissue; these fibres, which we have frequently followed as far as the bladder, and which seem to us to be an appendage of the muscular tunic of this pouch, become more evident towards the superior portion of the gland; so that, for example, superiorly, they sometimes exist almost alone upon the upper part of the canal of the urethra; and it is doubtless this circumstance that has induced M. Amussat to say that the prostate is not perforated by this canal, but that it merely forms a kind of gutter into which the urethra is received. We must admit that we have more than once met with the disposition indicated by this anatomist, that is to say, that the glandular tissue terminated upon

the sides of the canal, so that the anterior surface of the latter was in immediate contact with the fleshy fibres; but we think that he has gone too far, in drawing from this case a general conclusion: in fact, we may easily ascertain that the prostate gland, in the majority of subjects, forms a complete circle around the urethra; it is true that as the canal passes through this circle it lies much nearer its superior than its inferior part, although the contrary is sometimes observed;* a disposition which would be very dangerous, because it would then be very difficult to avoid the rectum, except by the transverse lithotomy. In addition to this species of fleshy envelope, the prostate also receives upon its superior surface two muscular fasciculi which appertain to the levator ani, but which are detached from it behind the symphysis of the pubis, descending almost perpendicularly upon the origin of the membranous portion of the urethra; they vary in strength in different individuals, and are known in England under the name of the muscles of Wilson (*musculus constrictor urethrae*); in the next place, the gland is enveloped by an almost complete fibrous sheath, which is continuous, on the one hand, with the recto-vesical aponeurosis, from which it seems to originate, and on the other, with that of the perinæum, upon which it terminates after being expanded upon the membranous portion of the urethra; finally, on the outer surface of this aponeurosis we find the cellular tissue, which is lax and abundant anteriorly and laterally; very dense posteriorly, upon the median line, and much less so externally. The base of the prostate envelopes the neck of the bladder like a cap, at the place where it terminates in the commencement of the urethra; it also receives the vasa deferentia which touch one another upon the median line, where they are about to dip into it; externally and posterior to these ducts, are the vesiculæ seminales; so that in penetrating into the bladder by the rectum, according to the first method of M. Sanson, that is to say, by opening the bas-fond of the bladder at the same time that we incise more or less the base of the prostate gland, we almost always cut one of the vasa deferentia and frequently the vesicula seminalis, for it is scarcely possible that any

* M. Senn, loc. citat.

surgeon can be sure of not deviating half a line from the median line when dividing the anterior paries of the rectum.

Now this accident, which does not appear serious to MM. Sanson and Vacca, is considered by Scarpa* so dangerous as to induce him to reject the recto-vesical lithotomy. In fact, it is proved from several cases, that a division of these excretory canals may be followed by their obliteration and atrophy of the gland; and with respect to the testicle in particular, Lapeyronnie has related an example which shows that an obliteration of the vas deferens may occasion the loss of the seminal gland. It is necessary to observe, here, that the ejaculator ducts traverse the prostate from behind forwards, and in such a manner that they pass through almost the whole length of this gland; so that, in the operation of lithotomy by the rectum, one of them will necessarily be divided, whatsoever precautions we may take, and two serious consequences may then result from it; viz. inflammation of the testicle, an inflammation which will be transmitted to it by the duct which unites it to the canal of the urethra; or the cicatrix will alter the relations of the divided extremities of the seminal ducts, and their separate obliteration will be followed by sterility, and perhaps by atrophy of the testicle: a result which may also succeed the former case: besides every one knows how common it is to see a swelling of the scrotum supervene during gonorrhœa even of the mildest form, from the use of bougies, catheters, as well as after the operation of lithotomy, even by the lateralized method.

In some subjects the posterior border of the prostate apparently consists of three lobes, so that, if the middle tubercle should become tumefied it will push the neck of the bladder from below upwards, so as to flatten and even obliterate it: this, according to Sir E. Home, is one of the most frequent causes of the retention of urine not dependent upon a disease of the urethra, in old men; but we think that this surgeon has greatly exaggerated the importance of the prostate in his investigation of the diseases which he attributes to this gland. If it is true, as he pretends, as well as M. Serres, that it is developed by two lateral lobes to which, at a later period a third is added, we con-

* Saggio di osservazioni sul taglio retto vesicale, etc. Pavia 1823.

ceive that the two former may unite below the canal of the urethra only, and give rise to the disposition pointed out by M. Amussat; but if, on the contrary, they first become conjoined above the urethra, this canal will then be situated much nearer the rectum. However this may be, the part which this organ performs, in relation to the operation of lithotomy, deserves much more attention than has been paid to it until the present day; and, in this respect, we cannot examine it too attentively. Its form, exact dimensions, relations and density cannot be too well known by the operating surgeon.

An important rule, from which we should never deviate, when we divide the prostate from the urethral canal to its circumference, consists in not prolonging the incision, in any case, beyond its periphery; for, if we neglect this precaution, as the neck of the bladder will be divided to a greater or less extent, and as the lips of the wound of the prostate are no longer maintained in contact by the solid tissues which surround this gland, or by a vinculum of its parenchyma of a certain thickness, they remain separated in such a manner that the urine can readily become extravasated into the circumjacent cellular tissue. Under such circumstances, we have two things to apprehend;—urinary fistulæ, or inflammation of the cellular tissue, more or less abundant, which surrounds the prostate and the neck of the bladder. The latter accident is the most formidable and frequent: this alone destroys more patients than all the others combined; when death takes place in the course of the first weeks which follow the operation, we sometimes find its cause in an inflammation of the peritoneum; but, generally, this phlegmasia is only an effect of the more or less extensive inflammation of the cellular layer which exists between the prostate and the rectum, between the prostate and the pubis, between the perineal fascia and the pelvic aponeurosis; a cellular layer, moreover, which is prolonged between the peritoneum and the bladder so as to enter in the fascia propria. It is sufficient to examine attentively the bodies of those who perish in consequence of the sub-pubic lithotomy, in order to be convinced of the correctness of what we have advanced; and Dr. Key perfectly coincides with this opinion;*

* A short treatise on the Section of the Prostate Gland, in Lithotomy. London. 1824.

consequently, all the efforts of the surgeon should tend to divide this gland in its greatest possible extent without ever passing completely beyond its circumference. Now, according to this principle, by what method can we obtain the greatest advantages? The question is easily solved. By the *apparatus major* the incision did not extend so far as the posterior part of the prostate, it is true; but then, the origin of the urethra was not divided, and it afterwards became necessary to dilate or lacerate, or the vesical opening would necessarily remain very small, notwithstanding the extent of the wound of the external soft parts. By following the *method of Foubert*, we avoid the prostate; we penetrate through the great ischio-rectal cellular space, and thereby incur the dangers of which we have just spoken. By the *Lateralized method*,* if we imitate Boyer, that is to say, if we withdraw the lithotome transversely, by applying the back of its sheath firmly against the right pubic ramus, in order to avoid the rectum, on the one hand, and the pudic artery on the other, it would be dangerous to give more than ten lines and a half to the incision, since the transverse radius of the gland presents but nine, and only two or three lines more can be added for the urethra. By the operation of Cheselden, on the contrary, whether we adopt the modifications recommended by Ledran, Pouteau, Moreau, Lecat, Frère Cosme, etc., as we divide the gland parallel to its greatest radius, that is to say, obliquely outwards and downwards, it is evident that we would obtain two lines more

* It may not be improper to define here the French terms *Lateralized* and *Lateral* operations of Lithotomy.

Lateralized Apparatus (Appareil Lateralisée). This method, which is almost exclusively adopted at the present day, except in those cases in which the excessive magnitude of the stone obliges us to cut above the pubes, this method, I say, consists in making upon the skin of the left part of the perineum, an incision which is begun at about an inch above the anus and terminates at the middle of a line which would be drawn from the anus to the tuberosity of the ischium; in dividing the adipose cellular tissue which fills the space between the erector penis and accelerator urine muscles; in afterwards incising the transversalis perinaei, and the anterior fibres of the levator ani muscles, the membranous portion of the urethra, the neck of the bladder, and the left lateral part of the prostate, &c.

Lateral Apparatus (Appareil Lateral). This method, invented by Foubert and Thomas, is distinguished by an incision made in the perineum along its external part, and by the section of the lateral part of the body of the bladder without touching either its neck or the urethra, &c. Dictionnaire de Médecine, tome 13.

--Transl.

without danger; so that, in this point of view, the lateralized method, properly so called, should have the preference. By the recto-vesical method, which only deserves that name when we divide the *bas-fond* of the bladder behind the prostate, we see that this gland, in the other process, will admit of an incision only eight lines and a half to the vesico-urethral neck, notwithstanding a great portion of the membranous part of the urethra and the whole length of the prostatic portion may be divided; so that far from obtaining by this method a very large opening, it will, on the contrary, always be smaller than by the other processes, whenever the incision shall not extend beyond the gland upon the neck of the bladder.* As it respects the lithotomy of Celsus, according to the method of M. Dupuytren, it is evident that we may obtain by it ten lines and a half on each side, since the two blades of the instrument follow, in coming out, the greatest radius of the gland; to this we may add the breadth of the canal of the urethra, which may extend to four or five lines; besides, as this double oblique incision circumscribes a triangular flap, including the ejaculator canals, the verumontanum, and the inferior half of the prostatic portion of the urethra, we conceive it possible, rigorously speaking, to obtain a wound about two inches in extent, without serious consequences. Finally, in operating as advised by Thompson in 1806, and M. Dupuytren, that is to say, that if after the *lithotome* or bistoury has entered into the bladder, the surgeon, instead of directing it downwards and outwards, carries, on the contrary, its cutting edge upwards, towards the arch of the pubis, in dividing the superior part of the prostate and of the neck of the bladder, we may readily perceive that he will incur the inconveniences arising from the lateral method of Foubert, and that the urethra, open above and below, will present two very broad slits (*boutonnieres*), without thereby actually rendering the extraction of the foreign body

* The foregoing sentence will be rendered more clear by stating, that there are two methods of performing the recto-vesical operation: in the first, we divide the anterior, inferior and median part of the rectum, the membranous portion of the urethra, the neck of the bladder and the prostate; in the second, these last parts are avoided, and the instrument merely cuts through the parietes of the intestine and the *bas-fond* of the bladder which is applied against it. Vide Dictionnaire de Médecine, tome 13, page 221.—*Transl.*

more easy, since the superior radius only of the gland will be divided. We will now pass in review the different parts of the canal of the urethra.

That portion of the canal which is included in the prostate gland is infundibuliforme, at its point of union with the bladder; a line or two anterior to this, it is a little narrower; it then expands anew, and again becomes contracted at the commencement of the membranous portion. It is upon its inferior paries especially that these peculiarities are remarkable. The neck of the bladder was for a long time supposed by anatomists to be a sphincter; but surgeons of the present day generally deny that it performs this office; M. Amussat, however, by his interesting researches, has again attempted to make it perform a very important part relatively to catheterism. This anatomist supposes, in fact, that there exists at this point a perfect valve, in which we sometimes meet with transverse fleshy fibres, and against which the beak of the catheter not unfrequently strikes. From our own investigations we are induced to say that we think this valve, called *pyloric* by M. Amussat, does not exist in reality, at least in the greater number of subjects; but, that the point of origin of the urethral canal is here raised by the posterior border of the prostate, and that all its membranes, although not disorganized, present a greater degree of thickness in this point than elsewhere: in the middle of the species of excavation which exists between this contraction and that which is anterior to it, we observe the *urethral crest* or *verumontanum*. This eminence, situated upon the median line, divides the inferior paries of this canal into two equal parts, over which the extremity of the catheter must glide before it reaches the bladder; and, as the mucous membrane is very thin in this place, and the excavation is sometimes pretty deep, it becomes necessary, in order to avoid making a false route, to keep the beak of the instrument against the superior wall of the urethra. M. Lisfranc says that he has seen this excavation, in some subjects, as much as three or four lines in depth. The crest itself is an essential organ, and one which requires much attention during the employment of bougies, the catheter, and especially when we introduce caustic into the urethra, because its irritation is transmitted with the greatest facility to the testicle by the vas deferens. It terminates about ten lines and

a half anterior to the neck of the bladder, where it forms a kind of tubercle more or less rounded, upon the middle of which we observe the mouths of the ejaculatory ducts,* and it is upon its sides that we see the orifices of the excretory ducts of the prostate which are arranged in two rows, so as to circumscribe a V, the point of which would be forwards.

It is not very unusual to see this tubercle depressed at its centre, in which cases it is supposed that the extremity of the instrument which we are endeavouring to pass on to the bladder may become insinuated into it, a circumstance which would not fail to lead to somewhat serious inconveniences in consequence of the lesion of the seminal ducts. But, if it is true that this obstacle is sometimes really met with, since M. Lisfranc has seen several cases in which a catheter of large calibre might very easily penetrate into this *cul-de-sac*, yet it must be admitted that the difficulty more frequently arises from the instrument being stopped in the bottom of the lateral sinuses. The verumontanum, in prolonging itself backwards to form the vesical uvula (*luette vesicale*,†) sometimes expands and gives origin to two small lateral folds, concave anteriorly, and which then present, in fact, the appearance of two very thin but scarcely distinct valves. Might it not have been these folds which imposed on M. Amussat? Be this as it may, it is easy to comprehend that if from some cause or another they should be developed more than usual, they might occasion considerable difficulties in the introduction of the catheter. In passing towards the membranous portion, that is to say, forwards, the urethral crest now and then presents a disposition similar to the preceding; but then the concave border of the fold looks backwards; neither does this appear to be a very rare occurrence, for we have met with it three times, and it is de-

* The inferior extremity of the vesicula seminalis and of the vas deferens terminate in an extremely narrow duct some lines in length, which we will call "*canal ejaculateur*" (ductus ejaculatorius). This duct converges from behind forwards and from above downwards towards that of the opposite side, penetrates into the substance of the prostate, and opens into the urethra immediately by the side of the latter in the middle of the verumontanum. (Meckel, tome 3, p. 360.)—*Transl.*

† *Luette Vesicale*.—Lieutaud gives this name to a small tubercle situated at the inferior part of the neck of the bladder, corresponding to the anterior angle of the vesical trigonum. It is sometimes almost indistinct, at others more strongly marked, &c. Dictionnaire de Médecine, tome 13.—*Transl.*

lineated by Laugenbeck in his *Treatise on Lithotomy*, published in 1802.

This portion of the urethra, being enveloped by the prostate, is generally less below than extensible above, and, in this respect, the difference is very great especially in those subjects in whom the gland does not form a complete circle around the canal: then, the superior wall is thick, muscular, very strong, and its extensibility permits us to obtain a considerable dilatation, for the extraction of the stone, without laceration; so that it is very difficult to make a false passage by following this superior paries, whereas it is not so with respect to the inferior portion. When the canal is reduced to its simple elements, that is to say, when it is divested of the prostate, its thickness, superiorly, is scarcely changed; its inferior portion, on the contrary, is then very thin, and almost entirely constituted by the mucous membrane, covered by a thin layer of fibrous tissue, a layer which is a little thicker in the situation of the two contracted portions mentioned above. In fine, it seems that the prostatic portion of the urethra is merely a simple prolongation of the bladder, between the membranes of which the prostate is developed in such a manner that it derives a sheath from its muscular tunic, whilst its inner surface is lined by the mucous membrane covered by its fibro-cellular tissue.

In the adult, the prostatic portion of the canal of the urethra is so large or dilatable that we may introduce into it, from the bladder, the extremity of the index finger without producing any laceration, as Deschamps and M. Carcassonne have already remarked: it will always stop, however, at the anterior contracted portion, which we have never been able to penetrate, in this manner: whence it follows that, in the extraction of calculi, we may always expect to obtain five, six, seven, and even eight and a half lines of dilatation in the posterior part of the urethra. In the child, this portion is always more raised than in the adult, because the bladder, more approximated to the umbilicus, tends to draw it behind the pubis. In women, during pregnancy, the same phenomenon is produced by the growth of the uterus, and so also in man, when the rectum is loaded with fæces. It must be observed, however, that this elevation, and the curvature which results from it, are much less than is generally supposed. M. Amussat has, in fact, demonstrated that the latter may be al

most completely removed by drawing upon the penis in such a manner as to make it describe with the fore part of the pubes an angle of about forty degrees. By so doing, the prostate is drawn under the arch of the pubes, and the posterior part of the canal, which was a little more elevated, is then found on a level with the *bas-fond* of the bladder; so that a straight instrument passes with the greatest facility into this cavity, which permits us to introduce those of a much larger size than if they were curved; to overcome obstacles with greater facility, because we can always rotate these straight rods upon their axis as we propel them onwards; to effect a considerable dilatation, and thereby be able to pass catheters of a very large calibre, and every variety of instrument, for the purpose of breaking down and extracting calculi. To us it appears that this new discovery must be fruitful in advantageous results, and the period perhaps is not remote when the major part of calculous individuals will be cured without the necessity of cutting the perinæum; we know, moreover, with what zeal, with what ardour, MM. Amussat, Leroy, and Civiale are engaged in bringing to perfection the lithontriptic processes devised from this idea. The interesting work on Lithotomy, by Dr. Key, after the method of Cheselden, is founded upon the same principle; and we observe from the elegant engravings which accompany his treatise, that he has arrived at the same result with our colleague M. Amussat, that is to say, he has ascertained that we can render the canal of the urethra straight, or nearly so; that we can and should perform lithotomy with a straight staff, which affords the great advantage of permitting the groove of the staff to be turned in whatsoever direction we may judge most proper. We must remark on this occasion that Dr. Key has not spoken of M. Amussat, notwithstanding it is very difficult to believe that the researches in which our fellow citizen has long been engaged have not come to his knowledge. His silence upon this subject gives some foundation to the charges which have already been frequently brought against some English surgeons, who too often repeat in London discoveries long before made at Paris, without indicating the source whence they derive them.

We do not mean to infer, from what has been said above, that that the prostatic portion of the urethra has no curvature, but

merely that it is easy to efface the curvatures, and to employ straight instruments, when they appear most suitable for the accomplishment of some particular indications. Every one agrees, says M. Amussat, that the urethra of the female is straight or nearly so; therefore, why should we not admit the same thing with respect to the prostatic portion of that of man, since it is not more elevated by the prostate gland in the one than by the vagina in the other? The comparison is not just, and doubtless M. Amussat did not consider that, in consequence of the pelvis in man being narrower, his bladder is raised more behind the pubes; that as the symphysis of these bones descends a little more, the urethra must necessarily be more curved, and also that in those cases where the symphysis presents twenty-five and a half or twenty-six and a half lines, as has been observed by M. Leroy,* instead of twenty-one lines, which is the average extent, this curvature will be so great as to render the introduction of a straight staff at least very difficult, if not impossible.

(b) *The Membranous Portion.* Superiorly, it is about an inch in length, and placed under the arch of the pubes, from which it is separated by a space of about six lines; a space which is filled by cellular tissue and by the small muscular fasciculus called Wilson's muscle, which descends from the posterior part of the symphysis upon the urethra anterior to the prostate. Through this space the dorsal veins of the penis enter the pelvis in their course to the hypogastric vein, and the corresponding arteries also traverse it, immediately on leaving the ischio-pubic ramus, in order to arrive at the dorsum penis. Sometimes these two arterial vessels unite, in order to form only a single dorsal branch; occasionally, this anormal union is not attended with any alteration in the disposition of the pudic arteries themselves; but, at other times, it is owing to the dorsal arteries of the penis deriving their origin from one of the branches of the hypogastric (*internal iliac*), as we have observed in two subjects; and, in this case, if we examine the vessel from before backwards, we will find that, from being single without, it bifurcates at its entrance into the pelvis, upon the fore part of neck of the bladder, and that the two branches of this bifurcation may be traced to

* Leroy (d'Etiolle), *Exposé des divers procédés pour guérir la pierre sans avoir recours à l'opération de la taille.* Paris 1825.

the vesical or ischiatic arteries. Consequently we see that such a disposition would almost necessarily lead to hæmorrhage, if the operation of lithotomy was performed according to the method of Foubert, and still more certainly that of Thompson and Dupuytren, that is to say, if the urethra and neck of the bladder were divided in their superior paries; the same accident might also happen in operating for the stone with the gorget modified by Scarpa.

Inferiorly, the membranous portion of the urethra appears shorter, because the apex of the prostate and the bulb converge towards each other; whence results a species of excavation at which we must always penetrate, when we perform the subpubic lithotomy upon the median line. This excavation, bounded posteriorly by the fore part of the rectum; anteriorly, by the bulb; laterally, by the recto-vesical fascia and the anterior portion of the rectal lamina of the ischio-rectal aponeurosis; inferiorly, by the most remote part of the perineal ligament, or deep seated lamina of the perineal aponeurosis properly so called; this excavation, we say, is filled by a dense cellular almost fibrous tissue, by some arterial and venous twigs, and, between the aponeurosis and the skin, by the intersection of the transversi perinæi muscles, the arteries of the bulb and the subcutaneous layer. More immediately, the membranous portion of the urethra is enveloped by a prolongation of the fibrous sheath of the prostate; a prolongation which gives to it much more strength and resistance than, at first sight, we would be disposed to allow it. In still more intimate connection with it we find a complete muscular tunic, which is sometimes very distinct and strong, sometimes, on the contrary, as if transformed into the yellow tissue. The arrangement of this muscular membrane is so remarkable that it is worthy of a moment's consideration. Thus, the most exterior fibres are vertical, and evidently depend upon the expansion of the muscle of Wilson, and as the fixed point of this muscle is behind the pubes, it follows that its contractions may draw the urethra more or less upwards, but without compressing it in a very evident manner. The deeper seated are parallel to the direction of the canal, and appear to be a continuation of those which surround the prostate; that is to say, they seem to originate from the neck of the bladder, and in such a manner that, be-

ing crossed by other annular fibres, when their contraction takes place, the urethra may be firmly constricted, so as to repel the bougie or catheter which we are attempting to introduce into the bladder : in this way we may account for the spasmodic stricture, which is observed by all surgeons, rendering the introduction of the catheter impossible for a few moments, but afterwards admitting of its ready passage.

At the interior, this part of the urethra is narrower than that which is included by the prostate ; so that it expands in becoming confounded with the latter, and also again grows wider as it enters the bulbous portion : whence it follows that foreign bodies, in their course along this canal, frequently stop at this place, and that it is generally between the spongy and membranous portions that we most frequently meet with false passages after forced catheterism. The membranous portion of the urethra, in enlarging before and behind, seems to become so much the weaker, because its more external laminae separate for the purpose of enveloping the prostate or the bulb ; it is in its middle portion, therefore, that its strength is greatest ; so that the catheter does not deviate in the excretory canal of the urethra until it has entered the membranous portion, or rather, until after it has passed beyond it, because the species of anterior neck is also strengthened by the perineal ligament, through which it passes as it comes from the pelvis, and farther because in this point the penis raises the urethra pretty firmly. But it is necessary to observe, that, if the instrument makes a false route at this part, it may continue to glide under the aponeurosis even into the anal region, and, that in this direction, the accidental passage will be less dangerous than in those cases in which the catheter passes to the circumference of the prostate and of the neck of the bladder. Let us always be understood that the inferior paries alone presents these peculiarities, and that the extremity of the catheter runs no risk of deviating, if we follow exactly the superior portion. Finally, we may say that the membranous portion of the urethra possesses the most part of the characters of structure which appertain to the bladder ; that is to say, the fleshy tunic still exists in it, and that the ancients, guided by their philosophical ideas of anatomy, had very correctly observed that the urinary reservoir and its canal were only a continuation of each other.

in organization as well as in continuity, and that the name *fleshy* or *muscular* which they gave to this portion of the urethra, a name which M. Amussat has again proposed, was perhaps more appropriate than that of membranous, which we employ at present.

(c) The *Bulbous portion* is, merely the origin of the spongy portion, and is particularly remarkable for the pyriform expansion of its proper tissue, as it is prolonged backwards below the canal, and which is called the *bulb* of the urethra. This bulb is separated from the skin only by the superficial cellular layer and the accelerator urinæ muscle, so that in thin persons, it may be easily distinguished from the exterior. It is only about one inch distant from the anus, and sometimes the distance is much less than this, therefore, in order to reach the membranous portion of the urethra, in the operation of lithotomy, we have two dangers to avoid; wounding the rectum, if we cut too far back,—and the division of the spongy tissue, if we remove more than one inch from this intestine. There is, doubtless, less danger in the latter case than in the former, notwithstanding hæmorrhage may follow from dividing the transverse perineal artery, as well as that of the bulb itself; but it is easy to avoid wounding the bulb, even when the incision is begun further forwards; and it is sufficient for this purpose, after the division of the integuments, to cut upon the nail of the left index finger, at the same time that this finger depresses towards the right, the internal lip of the wound. By acting in this manner, there is no danger of perforating the rectum, and the transverse artery of the perineum (*bulbo urétrale*) is the only one which may be divided: now, as it is seldom avoided, even when the anterior angle of the wound is made much nearer the anus, it appears to us to be altogether advantageous to commence the incision, in the lateralized lithotomy, sixteen and even nineteen lines before this aperture. By the apparatus major, the incision being made upon the median line, the bulb was necessarily divided; by following that of Celsus it is always avoided, since by the method of Béchard, as well as that of M. Dupuytren, the concavity of the semilunar wound should be upon the perinæum only six, eight, or ten and a half lines anterior to the anus; finally, by the process of MM. Sanson and

Vacca, in the recto-vesical lithotomy, the bulbous portion and the greater part of the membranous portion of the urethra are avoided.

In examining the urethra and its bulb from before backwards, we see that they follow a different direction; and this circumstance upon which M. Amussat lays great stress, in attempting to prove that the urethra is straight, or nearly so, seems to us to prove precisely the reverse. Indeed, if the penis is erect, or is placed in the direction which it then assumes, the bulb is prolonged backwards in the same line directly towards the anus; that is to say, that if the urethra followed this direction, it would be exactly straight, and would present no curvature; now, on the contrary, it deviates to such a degree from this line, that in penetrating by the perinæum, it is necessary to cut through parts an inch or an inch and a half in depth, and sometimes even more, before we reach the prostatic portion; hence we must conclude, that the urethra, in its natural state, when passing under the arch of the pubes must form a considerable curvature, but that this curvature may be greatly diminished, and even almost effaced by drawing upon the penis in a certain manner, and thereby easily permit the entrance of a straight staff into the bladder, although it is better to employ curved instruments, whenever particular indications do not demand the other.

When we examine the bulb in its relations with the urethra, we see that it is at first separated from this canal by a triangular space, which make a part of the *bulbo-rectal excavation*, but soon approximates its inferior paries, and a few lines further forwards terminates by forming a layer which envelopes the urethra almost completely; or rather, it seems that the erectile tissue, primitively included between the layers of the urethra, becomes gradually rarefied, dilated downwards and backwards, in order to produce this bulb, so that in consequence of the laminae of this canal being much more separated at this point, it is rendered weak and lacerable previous to its entrance into the membranous portion, the anterior contraction of which, easily appreciated by sliding the finger along its inferior paries, seems to be owing merely to the approximation, to the more intimate union of these same laminae, which are then of a nature altogether fibrous.

This portion of the canal terminates at its entrance into the inferior groove of the penis, where it assumes the name of spongy portion.

(*d*) The *Spongy Portion* therefore, is not separated from the bulbous portion by any distinct line of demarcation. Considered exteriorly, it insensibly decreases as far as the anterior extremity of the corpora cavernosa where it bulges out and expands in order to form the glans; the erectile (*spongy*) tissue, always included between the laminae of the canal, is so much the thicker the nearer it approaches the bulbous extremity; and, as the fibrous tissue which envelopes it is almost inextensible, it follows that during erection, it considerably diminishes the calibre of the urethra: therefore, when this state of the penis exists, the urine is with difficulty evacuated, whilst on the contrary, this state is very favourable to the ejection of the semen, because, being previously poured by the ejaculator ducts into the prostatic excavation, it is forced to pass from a broader into a narrower channel, and in consequence of a law purely physical, its exit is thereby rendered much more rapid, so that it is ejected to a greater or less distance into the sexual organs of the female; we also conceive that, having passed into the membranous portion, the fleshy tunic of this part, assisted by the ejaculator muscles, must tend to throw it out by jets. Finally, this portion of the urethra is covered by the skin of the penis and the subcutaneous layer only; superiorly, it is so firmly united to the groove of the penis, that some persons have supposed that the canal of the urethra was developed between the layers of the fibrous sheath of the corpora cavernosa; but these two parts are, in fact, only united by albugineous filaments and some very small vessels which permit minute injections to penetrate into the corpora cavernosa. though thrown in at the bulb, and *vice versa*.

At the interior, the spongy portion of the urethra becomes but very slightly contracted from the posterior to the anterior part; behind the meatus urinarius it is considerably dilated, and forms the *fossa navicularis*. The existence of this dilatation appears to us to be real, and we think that the anatomical reasons given by M. Amussat in order to prove the contrary, are very far from satisfactory; indeed, it is sufficient in the dead subject, to fill the urethra with a fluid capable of coagulating on cooling to be con-

vinced that this canal is dilated at this point. In the living subject, the same result may be obtained by allowing a soft bougie to remain in it for a few minutes; and if it is true that after death, the texture of the glans, more dense, keeps the mucous membrane more tense and dilated at this point, whilst behind it the spongy tissue of the urethra shrivels and returns upon itself, so as to occasion the dilatation in question, the same thing equally exists during life, so that the whole is reduced to a mere dispute of words. As for the rest, the fossa navicularis, as well as the other dilated portions of the canal of the urethra, exist particularly upon its inferior paries; it is in this that the inflammation generally commences in gonorrhœa; and some persons have even supposed that the disease became dangerous when the inflammation extended beyond this point.

The *mucous membrane of the urethra* is white, having a reddish tinge throughout its whole extent; upon each paries there is a whitish line, more or less distinct, extending as far as the bladder, and which is supposed by several modern anatomists to be a species of suture resulting from the union of the two halves of which this canal is composed in the early days of embryonic existence.

This membrane is plicated longitudinally; and as these wrinkles are produced by the canal, from its simple elasticity, returning upon itself when empty, after the distending cause has been removed, it follows that the fossa navicularis, which is not subject to these changes, does not present any: between these wrinkles we find others less distinct, transverse or semilunar, having their concavities directed forwards, which if they were more developed, would form so many valves, and which limit small spaces known by the name of *Lacunæ Morgagni*. These lacunæ are seldom so deep as to check the passage of the catheter: but, the following are the obstacles which this instrument may meet with previous to reaching the bladder.

First, we find the meatus urinarius sometimes pretty narrow in comparison with the fossette behind it. Having passed the posterior limit of this fossette, the instrument readily penetrates as far as to a level with the suspensory ligament of the penis, provided its beak is directed along the superior portion of the canal, for if we carry it along the inferior paries, we run the risk

of folding the membrane, and thereby creating obstacles. At this place the urethra appears to be weakened by a sort of crease (*brisure*), which results from the position of the part during relaxation; so that at this point some precautions are necessary; afterwards the instrument passes freely to the termination of the bulbous portion, where it is liable to deviate and tear the cul-de-sac which is there met with, unless the beak of the catheter is kept applied exactly upon the superior paries. Having entered upon the membranous portion, it proceeds without danger into the prostatic portion; but then it may wound the verumontanum, or be stopped in its central depression when it is very deep, and especially lacerate the bottom of the sinuses on each side of this crest and pass through the prostate gland: lastly, when the fold which M. Amussat calls the *pyloric valve* exists, and presents a certain developement, it forms a final barrier, beyond which we cannot pass but by elevating very considerably the beak of the catheter. During this operation, it must not be forgotten that the urethra is an extensible canal, capable of being gradually dilated to such a degree as to admit the introduction of a cylinder of four or five lines in diameter, and so elastic that it promptly resumes its proper calibre after a similar dilatation: in consequence of this fact it is that, on the one hand, when pathological contractions exist, the benefits obtained by the use of dilating bougies disappear soon after they have been laid aside; and on the other, that we are enabled to introduce into the bladder, without inconvenience, large straight tubes, which afterwards serve to conduct other instruments, for the purpose of seizing, breaking or extracting calculi contained in this organ. In consequence of this extensibility, also, stones of considerable volume sometimes insinuate themselves into the urethra. Finally, we may readily infer that when foreign bodies have once entered it, they will be most likely to stop at the prostatic excavation, or at the origin of the bulb.

We possess a certain number of examples in which the canal of the urethra is not prolonged to the extremity of the penis, and in such cases the meatus urinarius is found on the inferior surface of this organ, more or less approximated to the pubis. This disposition appears to be owing to a simple defect of evolution, that is to say, that the cavernous bodies are developed in the

ordinary manner, but the urethra remains in its rudimental state, and consequently is removed to a distance from the extremity of the organ. *Epispadias*, or cases wherein the meatus urinarius is situated upon the dorsum of the penis, are also spoken of; but this is so rare an anomaly, that the small number of examples cited do not even bear the character of authenticity: they are, moreover, much greater deviations from the natural order than all the others.

x. *The Neck of the Bladder.*

By the *neck of the bladder* we mean that portion of this reservoir which extends from the point where the peritoneum abandons it to its entrance into the prostate, and we think, with Scarpa, that the part included in this gland should appertain entirely to the description of the urethra.

The anterior and lateral parts of this portion of the bladder are enveloped by a species of venous plexus, which is very much developed in those who have long been affected with disease of the bladder; this plexus is itself included in a lamellated, supple, extensible, and sometimes very abundant cellular tissue, which extends between the pubes and the bladder above the symphysis; this is the same cellular layer which we observed around the prostatic portion of the urethra; it separates the neck of the bladder from the levator ani muscle and the recto-vesical aponeurosis, and in such a manner that, in cutting from below upwards the prostate, the superior paries of the urethra and the termination of the bladder, according to the process of Thompson, inflammation from urinary infiltration, or phlegmonous inflammation simply, will be frequently developed in it: so with respect to the lateral operation, and especially by the method of Foubert and Thomas, will the urine almost inevitably extravasate into this layer, unless an urinary fistula should form. For the fleshy fibres of the bladder being divided transversely, the two lips of the wound will be drawn asunder whenever this organ contracts, so that the formation of the cicatrix must necessarily be with difficulty accomplished; and if the parallelism of the divided edges of the different layers of the wound be deranged ever so little, we conceive that the urine will readily become

effused into the lax cellular tissue of which we are speaking. We may also conceive the dangers of this operation when we consider the facility with which the trocar or bistoury may deviate around this organ, when we attempt to perforate it; seeing how they may wound the rectum, if they pass too far posteriorly, or pierce the peritoneum, if too much externally; or finally, plough between these different parts, if the bladder is not sufficiently distended.

The posterior and inferior part of the neck is its most interesting portion; it is generally called the "*bas-fond*;"* it is in relation with the rectum, from which it is separated by a simple cellular layer, usually of considerable density upon the median line, and much looser upon the sides. In the first direction, it very seldom contains fat, so that the intestinal and vesical parietes seem at first sight to be confounded, and thus form the rectovesical septum, a septum so thin that we may frequently distinguish, by means of the finger introduced into the intestine, the figure of solid bodies contained in the urinary reservoir; and, as it does not include large vessels, or other important organs, it has been advised to penetrate by this point through the rectum into the bladder. It is thus, for example, that Flurant of Lyons perforated the bladder in cases of retention of urine, and that M. Sanson first proposed operating for lithotomy. In either case it would be very dangerous to carry the instrument higher than an inch and a half, or two inches above the prostate, be-

* The *bas-fond* of the bladder extending from behind forwards from the rectovesical layer of the peritoneum to the origin of the urethra, continuous at the sides with the lateral regions of this organ, without any very distinct line of demarcation serving to separate them, and measured by almost equal dimensions in every direction, is united by solid adhesions to the ureters, vasa deferentia, and vesiculæ seminales, which, traversing it obliquely from behind forwards and from without inwards, thereby divide it into three surfaces, two of which are lateral, convex, broader before than behind, situated external to the vesiculæ seminales, and correspond to an abundant and fatty cellular tissue which separates them from the levatores ani, whilst the third, central, placed between the two spermatic reservoirs, triangular, having a base turned backwards, which corresponds to the peritoneum, and an apex directed forwards, corresponding to the prostate, rests immediately upon the rectum, the curvature of which it exactly follows as far as the gland. There it separates from it, and takes a direction obliquely from behind forwards, and from below slightly upwards, as far as the neck of the bladder, where it is confounded with the origin of the urethra, etc. (*Sanson des moyen de parvenir à la vessie par le rectum. Paris, 1817.*)—*Transl.*

cause the peritoneum generally descends thus far upon the rectum before it is folded behind the bladder: there, this membrane is so intimately united to the two viscera that its position is fixed and seldom varies; so that by keeping within the space just indicated, we are almost certain of avoiding the abdominal serous tunic. In the second, that is to say, upon the sides, the cellular tissue fills the two lateral grooves which result from the contact of the rectum with the bladder, which tissue generally contains adipose cells in its lamellæ, and we always find in it the vesiculæ seminales, vasa deferentia and the terminations of the ureters. As the latter penetrate the vesical tunics in the outer and most superior part of the *bas-fond*, they are not exposed to the action of the instruments in the two operations cited above. The vesiculæ, coated upon their internal borders by the vasa deferentia, circumscribe a triangle, the apex of which penetrates the posterior border of the prostate, and which is the only point in which we may operate with safety; but, as in the recto-vesical lithotomy, we are seldom sure of cutting directly upon the median line, if the incision approximates the gland ever so little, we will almost inevitably divide the termination of one of the vasa deferentia, and the commencement of the right or left ejaculator ducts. Further, we may also foresee that, if after this operation the parallelism of the wound is not exactly maintained, whether from the incision being too much on one side, or from any other cause, the urine will readily become extravasated into the cellular layer, and thereby give rise to consequences almost always mortal. On the other hand, it is well ascertained that wounds of the neck of the bladder generally remain fistulous, which might perhaps be explained by reflecting upon the arrangement of the muscular fibres and of the surrounding parts. In fact, some of these fibres are longitudinal, others transverse; the former are more numerous upon the lateral and anterior part of the neck; the latter, on the contrary, predominate inferiorly and posteriorly, where they form the *trigone*. Therefore, whether the incision is perpendicular to the axis of the parietes of the bladder, as in the lateral lithotomy, or parallel to it, as in the recto-vesical operation, this organ will never contract without one set or other of these fibres tending to produce a separation of the edges of the division, and as, moreover, they are not sup-

ported by any solid laminae, we conceive that its cicatrization will take place with difficulty, and we can scarcely believe that lithotomy, performed in such a manner as to incise the rectovesical paries between the prostate and the reflection of the peritoneum which separates the perineum from the pelvis, properly so called, is not a dangerous operation. Sometimes the *bas-fond* of the bladder, instead of being convex is concave, and represents a species of gutter applied upon the fore part of the rectum: in such a case the operation of lithotomy by this intestine would be more easy, and, by the lateralized method, it would be less formidable than where a contrary disposition exists.

The interior of the neck of the bladder represents a species of triangular funnel, the pipe of which is at the urethra, and which is formed below by the *vesical trigone*. This trigone, which rests principally upon the rectum in the middle, and laterally upon the vesiculæ seminales, receives at its posterior angles the openings of the ureters; but, as these canals have run between the tunics of the urinary cyst for the distance of five or six lines, such a disposition thence results, that the urine readily trickles into the bladder, but when it has once entered this reservoir, far from being able to regurgitate into the ureters, it on the contrary, shuts their orifices by the eccentric pressure which it exercises; so that the urine acts, in this case, in the same manner as liquids enclosed in vessels possessing a valve. This trigone and the whole of the *bas-fond* are generally on a more inferior plane than that which the commencement of the urethra occupies, which is raised in this point by the prostate. In children, this excavation is scarcely evident, or does not exist; the accumulation of excrement in the rectum causes it to disappear; and in very fat subjects, it is also pushed much higher, so that it sometimes becomes almost impossible, or at least very dangerous, to puncture the bladder from the rectum in these persons, in whom the former organ is raised, if I may so say, above the pubes, by the adipose layers which surround it. It is at the junction of the neck of the bladder with the urethra that we observe the commencement of the urethral crest, or *vesical uvula*, as well as the prominence, or sphincter vesicæ, when it exists.

XI. *The Rectum.*

We may say that so much of this organ as is situated below the place where it is enveloped by the peritoneum in the pelvis appertains to the perinæal region. Its direction is such, that it descends obliquely forwards between the sacrum and the *bas-fond* of the bladder, until it reaches the level of the prostate, when it reflects itself slightly backwards, in order to terminate at the anus. This portion of the rectum therefore, taken as a whole, presents a distinct curvature, the convexity of which corresponds to the posterior surface of the prostate, and which embraces the extremity of the coccyx in its concavity: whence it follows that, in order to administer an enema, introduce a suppository, or any other foreign body into this intestine, it is necessary to pass it first obliquely, from below upwards and from behind forwards, to the distance of about two inches, and afterwards to direct it upwards and backwards. As the anal extremity of the rectum is inclined backwards, it leaves between its anterior surface and the bulbous portion of the urethra a triangular space, which the instrument must always traverse in the operation of lithotomy; a triangle which is formed, superiorly and anteriorly, by the membranous portion of the urethra and bulb inclusively: posteriorly, by the fore part of the rectum, from the apex of the prostate to the anus, and, inferiorly, by the skin which forms the base of it. Laterally, this space is limited by the rectal lamina of the perineal aponeurosis. Inferiorly and anteriorly it includes the bulb of the urethra, and the apex of the prostate is found in its posterior and superior part. In it we meet with, from the skin towards the urethra, the cellular layer, the origin of the accelerator urinæ, intersected by the extremity of the external sphincter and of the transversalis perinæi muscle: the termination of the transverse artery of the perineum, some fibres of the levator ani, of dense and compact cellular tissue, the base of the perinæal aponeurosis properly so called, and the membranous portion of the urethra. The posterior border of this triangle, that is to say, the rectum, may be inclined more or less towards the coccyx; if this inclination is carried very far, we conceive that it would be very dangerous to make the in-

cision in lithotomy at less than an inch before the anus. In such a case, we would seldom fail, especially by the operation of Celsus, opening the rectum before we reached the prostate. This accident would be still more liable to happen in those subjects in whom the intestine is very much dilated immediately above the sphincter; and we have been informed that the lithotomy, according to the process of M. Dupuytren, has once been followed by this inconvenience. When, on the contrary, the anus is not so far back, the rectum is almost regularly concave forwards, as is observed in children, for example. We then penetrate into the bladder without danger; but in making use of the *lithotome caché*, it is very easy to divide the rectum at the same time with the prostate, because we are obliged to elevate the handle of the instrument considerably forwards when we are cutting the neck of the bladder. It is under such circumstances especially that the knife of Cheselden, that of Dubois, or the gorget of Hawkins, not as improved by B. Bell or Desault, but such as the inventor made use of, or still better as modified by M. Roux and Scarpa, that is to say, pretty broad towards its cutting extremity and retaining its groove; it is then, we say, that these instruments might have some advantages over others.

From the apex of the prostate as far as two or three inches above this gland, the rectum being separated from the bladder, the vesiculæ seminales, the vasa deferentia, and the prostate itself, merely by a cellular layer of but slight thickness, it thence follows that the distended urinary reservoir and the gland which surrounds the extremity of its neck, whether swollen or not, depress the fore part of the intestine in such a manner, that we may readily ascertain their state by the cavity of the latter organ; but, we repeat it, in choosing this route for the extraction of vesical calculi, numerous dangers are to be apprehended, especially if we cut open the *bas-fond* of the bladder without incising the neck of the urethra and the prostate: then we almost always have as a consequence a recto-vesical fistula. Besides, it will frequently happen that the vesiculæ seminales or vasa deferentia will be divided. In the third place, if the peritoneum descended very low behind the bladder, as Camper once observed,* this membrane would be comprised in the division. If, on the contrary, we fol-

* Demonstrationum pathol. lib. 2, p. 10.

low the process of Vacca, the latter accident will be avoided, and stercoraceous fistulæ will be less liable to happen; but one of the ejaculator canals will uniformly be incised, and although the section of one of these ducts may not, perhaps, be always so dangerous as B. Bell,* and Scarpa† pretend, yet we know that it may occasion the loss of the testicle.

In subjects habitually constipated, affected with chronic diseases of the bladder, those who have for a long time carried a calculus in this viscus, or who are advanced in age, the veins interposed in the cellular layer which unites the *bas-fond* of the bladder and the prostate to the rectum, sometimes become so much enlarged that their inevitable division in the recto-vesical lithotomy, and occasional section in the lateralized method, may be followed by profuse hæmorrhage. In consequence of the same circumstances the rectum, especially in old people, becomes greatly dilated above the anus: then, instead of being rounded upon its anterior surface, it represents a kind of groove, in which the prostate and *bas-fond* of the bladder are lodged; so that the rectum rises up more or less upon the sides of these parts, whereby in the lateralized and even transverse lithotomy it is difficult to avoid wounding the organ of defecation, and the more so because the rectum generally bulges out more on the left side than on the right. Sometimes, also, this portion of the alimentary tube is thrown entirely to this side of the pelvis,‡ in the same manner that, in other cases, it is very much inclined to the right. From these relations, we perceive that it is a very fortunate circumstance that stercoraceous abscesses seldom manifest themselves anterior to the anus; for, if it should become necessary to operate on fistulæ which would result from them in this direction, the urethra, neck of the bladder, vesiculæ seminales, vasa deferentia, and some arteries of considerable magnitude would be easily wounded.

Posteriorly and laterally, the rectum is only separated from the anterior face of the coccyx, the coccygæus and levator ani muscles, by the cellular tissue above the pelvic aponeurosis, which tissue however, is very abundant, very supple and sometimes

* System of Surgery. † Osservazioni sullo tagli. retto-visicale, etc.

‡ Deschamps, tome 3.

contains a great quantity of adipose cells, and which is traversed by twigs of the sacra-media artery, nervous filaments from the sacral plexus, etc. : whence it follows that phlegmonous inflammation may be developed in it, very rapidly followed by a copious purulent secretion, which will more readily ascend towards the abdomen, than penetrate to the surface of the perinæum. More inferiorly, that is to say below the recto-vesical aponeurosis, the rectum is enveloped by the muscles which have just been enumerated, and by the external sphincter ; consequently it is found immediately surrounded by the adipo-cellular tissue which fills the ischio-rectal excavations ; so that, in extensive stercoraceous abscesses, it can only be denuded in this latter portion, unless the muscular floor of the perinæum, and the two fibrous laminae which cover it, are disorganized or perforated in some points, cases in which the disease is very dangerous and most frequently irremediable.

Interiorly, this organ forms, in certain subjects a kind of bulging, of *cul-de-sac*, which permits the fæces to accumulate above the levator ani, and it is this dilatation which corresponds to the *bas-fond* of the bladder, as well as to the prostate. It becomes contracted as it traverses the perineal aponeurosis and sphincter ani ; so that, in the natural state, it is necessary, in most subjects, to use a certain degree of force in order to penetrate it ; it is generally wrinkled parallel to its length, and its plicæ, or perpendicular columns are intersected, or rather united, by transverse rugæ in the form of small valves, the concavity of which is directed upwards. There are a certain number of anatomists and surgeons, who actually admit that these lacunæ of the rectum are the principal organic disposition which favours the formation of fistulæ in ano ; they think that irritating secretions and foreign substances lodge more particularly in these small excavations, and there excite ulceration, which is soon followed by phlegmonous abscesses and fistulæ. It could not be denied that this explanation would appear natural, plausible, and even simple, if, on the other hand, it was proved, as Sabatier, MM. Ribes, Larrey, Richerand, etc. pretend, that the intestinal orifice of the fistula is never situated higher than two or three inches above the anus. In fact, this mode of accounting for these affections would be strongly supported by the anatomical arrange-

ment of these lacunæ of the rectum, which are so disposed that the mouths of the inferior are directed upwards, whereby they may retain substances capable of irritating and perforating them : whereas the superior, being turned downwards, are not exposed to the same inconveniences. But, on the one part, MM. Boyer and Roux continue to believe, with Desault and the ancient surgeons, that stercoraceous fistulæ sometimes have their internal orifice very high up : on the other, M. Ribes has observed, among the numerous cases detailed in favour of the new opinions, that that this opening not only does not extend very high, but that almost always it is situated a few lines only above the sphincter. Therefore, in these two cases, the explanation which is derived from the lacunæ, is no longer admissible, and hence we cannot regard it as general. Some modern surgeons have stated that, in operating according to the opinion of Desault, in these diseases, dangerous consequences might result because in penetrating the rectum four or five inches above the anus, in order to divide it between the two orifices of the fistula, we would run the risk of opening the peritoneum, in case it should descend lower than usual between the bladder and rectum. If we examine attentively the arrangement of these parts, we will readily convince ourselves that there is but little foundation for such apprehensions ; for, from the anal aperture to the most elevated part of the *bas-fond* of the bladder, from which the serous membrane of the abdomen is reflected, the distance is from four to five inches, and this tunic always descends a little less behind and upon the sides, the directions in which fistulæ are most uniformly met with ; besides, the cutaneous orifice of these sinuses is generally upon a plane much below that of the anus itself ; whence it follows that we may incise to the extent of six inches, without danger of reaching the peritoneum. It should also be noted that, if the rectum was perforated above the pelvic aponeurosis, an abscess would form in the pelvis, and for this reason we may conclude, that, when the phlegmon extends towards the surface, the superior orifice of the fistula is much less elevated than the peritoneum.

The mucous membrane which lines the rectum is supple, thick, and united to the muscular tunic only by a very lax and very extensible cellular lamina ; so that what we frequently call pro-

lapsus of the rectum is generally nothing more than a fold or protrusion of the villous tunic of this organ. M. Dupuytren removes and radically cures this protrusion in adults, by excising a more or less considerable portion of the soft skin which surrounds the anus. In 1820 we saw a woman treated in this manner at the *Hôtel Dieu*, and she was completely cured of this complaint in four days, notwithstanding she had been afflicted with it for many years. It appears to us that the efficacy of this operation is to be attributed to the inferior portion of the rectum being rendered more tense, the skin firmer, and the sphincters more solidly supported by all these parts, after the integuments have become cicatrized.

The fleshy tunic is formed of longitudinal fibres, which exist almost alone or, at least, predominate as far as on a level with the prostate, and of annular fibres, which gradually increase in number from this point to the skin, where they form the small sphincter previously spoken of, when on the muscles of the perineum. The superior hæmorrhoidal arteries, terminations of the inferior mesenteric creep between these fleshy fibres, where they form a very complicated net-work, the branches of which are lost in the internal tunic: these branches are frequently of considerable volume even at the inferior part, and as they ramify principally in the posterior half of the rectum, they may be divided in the operation for fistula and give rise to a troublesome hæmorrhage.

The venæ comites of the superior hæmorrhoidal arteries are of still larger size; as they form a part of the branches of origin of the great mesenteric vein, which receives almost all those of the digestive canal, we may admit with Broussais that, in diarrhœa caused by an inflammation of the large intestine, leeches are of more service when applied around the circumference of the anus than upon any other point of the abdomen, because these veins being destitute of valves, we thereby directly relieve the congestion. It is also from the relations of these veins with the system of the vena porta that the ancients founded a similar opinion in relation to diseases of the liver. These vessels, by their free anastomoses between the integuments and the sphincter, the mucous membrane and the fleshy fibres, form a plexus around the anal aperture, and are sometimes transformed into a species of erectile tissue, which, according to M. Recamier, is the organic cause of hæ-

morrhoids, whilst other authors continue to regard these tumours merely as varicose and dilated veins. It is evident that there is but very little difference between these two opinions, and that it would be easy to reconcile them ; but this appertains to pathological anatomy. We may also note that M. Ribes considers these veins as the primitive cause of a certain number of fistulæ in ano, because they may become excoriated, and open into the cavity of the rectum.

Children are occasionally born with a mal-conformation of the rectum, and sometimes this organ is simply contracted in its natural opening, as in the cases related by Roonhuysen and Boyer ; at other times it is obliterated in its middle, although the anus exists ;* or this aperture is closed by a membrane different from the skin, which may be situated at a greater or less elevation in the cavity of the intestine.† In certain cases there is no vestige of an anus, and the skin is as firm and thick at the point which this opening usually occupies as elsewhere.‡ Again, we find it obliterated throughout its whole extent :§ or, entirely wanting :|| it is not less uncommon to see it opening into the urethra.¶ into the bladder,** vagina,†† or externally, forming an artificial anus. It is from the latter circumstance that Litre,‡‡ Callisen, etc., proposed establishing an artificial anus either in the iliac or lumbar region, in children born with an imperforate rectum ; a practice which has been successfully adopted by Professor Dubois and M. Duret, of Brest.

Such are the numerous parts which enter into the composition of the perinæum in man, and which we are now to examine in their order of superposition, laying aside those varieties in thickness and transverse dimensions which they too frequently present, and which are such, that M. Dupuytren§§ has found in twenty-three subjects, for extremes, between the two ischiatic tuberosities, two inches and three inches and a half ; between the neck of the

* Petit, *Mem. de l'acad. roy. de ch.* † Engerran, *Mem. de l'acad. roy. de ch.* ‡ J. L. Petit, *Mem. de l'acad.* § Flajani, *Osservazioni di Chirurgia.* etc. || Morgagni, *de sedibus,* etc. Epist. 32. Ch. Triæn. *Obs. Med. Ch.* p. 60. F. de Hilden, *Obs. Ch.* cent. 1. obs. 75. Durr, *Ephem. des cur. de la natur.* Dec. 2. an 7 obs. 72. ¶ Van Swieten Morgagni, Haesbert de Jussieu. ** Schultz, Schenkus. †† Ruysch, Binninger, Wagner. ‡‡ Litre, Petit, Méry, *Mem. de l'acad. des Sciences*, 1709-10. §§ Thèse de Concours, 1812.

bladder and the skin of the perinæum, from one inch some lines to four inches. We ourselves have taken these measurements upon forty dead bodies, and the results have been the same with respect to thickness ; only, in relation to the separation of the ischia we have found from one inch and three quarters to four inches.

Upon the median line and anterior of the anus we find, 1st, the skin, presenting its raphé, and of considerable thickness ; 2d, the subcutaneous layer, of a reddish white, sometimes putting on the appearance of muscular membrane, of considerable thickness, and including venous and arterial twigs ; 3d, the superficial lamina of the perineal aponeurosis, and the anterior extremity of the sphincter ani muscle ; 4th, the accelerator urinæ and transversus perinæi muscles, and branches of the transverse artery of the perinæum ; 5th, the bulb of the urethra enveloped in its fibrous tunic, then the recto-bulbar hollow ; 6th, the bulbous and membranous portions of the urethra ; the former below the deep seated lamina of the perineal aponeurosis, the second principally above it ; 7th, this aponeurosis itself, perforated by the excretory canal of the urine and continuous with the sub-pubic ligament ; 8th, the prostate and prostatic portion of the urethra, in which we find the ejaculator canals, the excretory ducts of the prostate and the verumontanum.

In proceeding from the coccyx in order to arrive at the bladder we meet with, 1st, the skin, of considerable thickness behind the anus, very thin and wrinkled around this aperture ; 2d, the superficial cellular layer, thicker near the coccyx, very thin upon the sphincter ; 3d, the coccygeal prolongation of the external sphincter muscle ; this muscle itself ; 4th, a pretty thick celluloadipose layer, in which some branches of the external hæmorrhoidal artery ramify ; 5th, the coccygæus muscle ; 6th, the posterior wall of the rectum ; 7th, the cavity of this intestine ; 8th, its anterior paries ; 9th, the recto-vesical cellular layer, which encloses the venous plexus of the prostate, the vasa deferentia, the vesiculæ seminales and some fat upon the sides, whilst upon the median line it is compact and apparently aponeurotic ; 10th, the posterior border of the prostate and the *bas-fond* of the bladder.

Upon the sides and anteriorly we find, 1st, the skin, a little thinner than upon the median line and most frequently wrinkled ; 2d, the sub-cutaneous layer, in which the veins, nerves and su-

perforated artery of the perinæum creep, and which often includes a pretty large quantity of fat; 3d, the superficial aponeurotic lamina of the perinæum; the ischio-bulbar triangle; the erector penis, and transversalis perinæi muscles; the transverse artery of the perinæum; 4th, the corpus cavernosum, the deep-seated aponeurosis of the perinæum, including between its laminæ the deep branch of the pudic artery; 5th, some cellular tissue and vessels; 6th, the levator ani muscle; the lateral portions of the neck of the bladder; 7th, the recto-vesical aponeurosis.

In the anal portion, we observe successively, 1st, the integuments, thick and dense upon the sides where they approximate the breech; 2d, lamellated, filamentous and adipose cellular tissue in great abundance, filling the whole of the ischio-rectal excavation, and in which the external hæmorrhoidal artery and nerve ramify, as well as veins, in considerable numbers; 3d, the ischio-rectal aponeurosis; 4th, the levator ani muscle, internally; the side of the rectum and the pelvic fascia; 5th, the trunk of the internal pudic artery, accompanied by the nerve and veins of the same name; the obturator muscle externally, and again the pelvic aponeurosis.

Sect. 3. Pelvic Region.

This part is a species of cul-de-sac which terminates and forms the floor of the cavity of the belly. Its depth is about four inches and a half and its entrance is of a triangular form, with its base placed anteriorly and its plane very much inclined downwards and forwards; it is lined by a complicated aponeurosis and contains the bladder, rectum and many more organs.

CONSTITUENT PARTS.

I. The Peritoneum.

This membrane envelopes the rectum in such a manner as to form a duplicature (mésio-rectum) behind this intestine, which is much longer superiorly than inferiorly. In reflecting itself upon the sides, in order to line the excavation, it adheres but very loosely to the sub-jacent organs. Inferiorly, where it is passing

upon the sides of the bladder, the peritoneum forms two semicircles, which are called posterior vesical (recto-vesical, vesico-sacral) ligaments, which circumscribe the orifice of a cavity lined by the same membrane, and which is prolonged more or less downwards between the urinary pouch and the rectum. This cul-de-sac, which we will call *recto-vesical*, sometimes receives a portion of the small intestine, and we conceive that, under certain circumstances, a complete strangulation may result from it. The peritoneum adheres more firmly to the posterior and superior part of the circumference of the bladder than to its lateral portions. In short, it possesses the same characters in the pelvic excavation that it does in all the other portions of the abdomen.

II. *The Sub-peritoneal cellular tissue, or Fascia Propria.*

This layer provides a sheath for all the vessels, nerves, and to the ureters; it is interposed between the peritoneum and bladder, where it constitutes the *external nervous tunic* of the ancients, or the fibro-cellular membrane of some moderns; is likewise expanded in the same manner upon the rectum; envelopes the lymphatic glands; is separated from the pelvic aponeurosis by more lax and very extensible cellular lamellæ which generally enclose very large and soft fatty vesicles; in a word, it is every where spread out between the parietes of the pelvis and the organs which this cavity contains, between these organs and the abdominal serous membrane, and is, in fact, merely the pelvic portion of the general layer which lines the peritoneum throughout its whole extent. Being very loose laterally and anteriorly, it is peculiarly favourable for the production of phlegmonous inflammations, the products of which are, by its means, transported with great facility from one point to another. Behind the rectum, that is to say, upon the anterior surface of the sacrum, this layer blends itself with the periosteum and the termination of the pelvic aponeurosis; it is this which becomes thickened, lardaceous (*lardacé*), in consequence of chronic diseases of the peritoneum, and which permits pus to filtrate from the lumbar and iliac regions into the pelvis, and it likewise transmits into the

deep-seated parts of the inferior extremities the serosity infiltrated beneath the peritoneum.

III. *The Pelvic Fascia (fascia pelvis).*

This aponeurosis, of which we had only a very imperfect knowledge previous to the work of M. J. Cloquet, has since been repeatedly described with attention, especially by M. Carcassonne,* and still better by M. Bouvier.† It is attached, superiorly, to the circumference of the abdominal strait of the pelvis, where it is continuous in a more or less evident manner with the fascia iliaca and the inferior margin of Gimbernat's ligament; but in such a manner that a species of *bandelet* or transverse fibrous ribband, fixed upon the contour of the excavation, separates it from the fascia which covers the iliac fossa. Anteriorly, that of one side is only separated from its similar of the opposite side by an interval of about half an inch, behind the symphysis pubis; posteriorly, they stop at the sacro-iliac junctions, consequently, they are the whole breadth of the sacrum asunder. Anteriorly and laterally, this aponeurosis is disposed in such a manner, that its fibres form at first two small cords which descend upon the neck of the bladder and the prostate: these are the anterior vesical, or pubio-vesical ligaments, between which we see a small cavity filled with fat which gives passage to the dorsal veins of the penis; on the outer side of these ligaments the aponeurotic fibres also leave between them some apertures which are likewise filled with fat and small veins; still more externally the pelvic fascia attaches itself to a fibrous arcade with an inferior convexity, and which converts into a hole the notch which we observe in the upper and outer part of the obturator foramen. This aperture, which the obturator vessels and nerves traverse, is but the pelvic orifice of a canal which goes to open between the deep muscles of the thigh, and through which the viscera may protrude externally, forming herniæ; we may observe, however, that it is so small that it will not readily permit

* Recherches sur le manuel de la taille sous-pubienne, etc. Montpellier, 1821.

† Thèse sur quelques points d'anatomie, etc. 1823.

such displacements, since it scarcely admits the extremity of the little finger. From these different points of attachment, the aponeurosis descends obliquely inwards, and forms an inclined plane which looks backwards, inwards and upwards; its fibres, slightly convergent, fall upon a species of *bandelet*, of considerable strength, which extends obliquely from behind forwards, from the spine of the ischium to the posterior face of the pubis, on the external side of the anterior ligaments of the bladder. Departing from this *bandelet*, in order to pass towards the median line, the pelvic *fascia pelvia* again extends over the pelvic aspect of the levator ani muscle, as far as upon the sides of the rectum and bladder, in order to pass between these two viscera and behind the intestine. The first portion is applied upon the levator muscle anteriorly, and principally upon the obturator internus externally; so that we might call it the *lamina of the obturator*. The second, covering the former muscle and the sides of the rectum and bladder, unites with that of the opposite side, and forms but one lamina perforated by these last two organs: it is this which constitutes the *recto-vesical* aponeurosis, and its strength is much less than that of the former. The *bandelet* upon which the two laminae conjoin, and which we might name *ischio-pubic*, receives upon its inferior surface or margin the two laminae of the ischio-rectal fascia of the perinæum; it forms the bottom of a groove, or of an excavation much deeper posteriorly than anteriorly, and which represents in the pelvis, in a pretty exact manner, the ischio-rectal excavation of the perinæum: so that the fibrous *bandelet* under consideration actually forms a species of central cord, upon which the four aponeurotic laminae terminate.

A third lamina of the pelvic fascia is spread over, or binds down the pyriformis muscle, so that it is attached upon the sides of the median line of the sacrum and even of the coccyx, on the one part; upon the fore part of the great sciatic notch and of the spine of the ischium, on the other, and that its superior border is notched, or rather forms an inverted arch, similar to that of the obturator foramen, except that it is larger; a notch which is converted into a hole by the great ischiatic notch, and through which the nerves of the sciatic plexus, the glutæal, internal pudic, and ischiatic vessels pass out. This lamina repre-

sents a plane oblique inwards and forwards, which faces the opposite oblique plane of the lamina of the obturator. At the place where this plane unites with that of the obturator upon the internal surface of the ischion, we find the bottom of the groove which lodges the internal pudic artery (*ischio-pubic gutter*); posteriorly, they leave between them a triangular space upon the fore part of the sacrum, a space, the base of which is situated superiorly, and which is separated from the posterior face of the rectum only by some cellular tissue and fat, upon which the meso-rectum is applied. Finally, inferiorly, from the ischiatic spine as far as upon the fore part of the coccyx, it is separated from the posterior portion of the recto-vesical lamina by a groove which is oblique from before backwards, and from without inwards, which unites the ischio-pubic and sacral grooves: so that, supposing the rectum and bladder removed, if we examine the recto-vesical aponeurosis, this layer will present a quadrangular sheet, having one of its angles upon the coccyx, the second behind the pubes, and the two others upon the internal surface of the ischiatic spines. The other four laminae, namely, the two laminae of the pyriformes and those of the obturators, actually represent four triangles, having their apex rounded off inferiorly, and of which the two anterior are the widest, on account of the portion of the sacrum upon which the posterior two do not extend. Hence, it follows that they form four inclined planes which look in opposite directions, and which are worthy of attention in women, on account of parturition.

From this arrangement, we perceive that the floor of the abdomen is much weaker and less firm in those points which are covered by the recto-vesical aponeurosis than at the circumference of the pelvic cavity, and that the weakest point of all is that which separates the neck of the bladder from the rectum: therefore, it is at this point that the viscera, in perineal herniæ, escape from the pelvis. In these cases the small intestine, for it is this which generally forms the tumour, insinuates itself into the recto-vesical cul-de-sac, drives the peritoneum before it, pushes the *bas fond* of the bladder and the prostate forwards, depresses the rectum backwards, separates the fibres of the levator ani muscle, and traverses the recto-bulbar triangle, either directly, as in the case related by Chardenon, or by passing more

or less upon the side, as occurred in that published by Scarpa; but in such a manner as to protrude the skin of the perinæum almost always behind the transversalis perinæi muscle. Although the anatomical disposition of other viscera than intestine, does not seem to permit their escape by this route, it must not be inferred that their displacement in this manner is entirely impossible; indeed, Pipelet has recorded a fact which proves that the bladder may thus protrude, and form a tumour between the anus and urethra. In all these cases the reduction is generally easy, but it is difficult to maintain it; and it is a fortunate circumstance that their strangulation is rare, for the division of the stricture could not be made in any direction without incurring the risk of wounding some important organs, such as the bladder anteriorly, the rectum posteriorly, and the hæmorrhoidal artery, or even the trunk of the internal pudic externally. Finally, this species of perineal hernia is found enveloped by the skin, the cellular layer and the expanded fibres of the sphincter ani; those of the accelerator urinæ, another cellular layer and the peritoneum, if the tumour exists exactly upon the median line and before the anus; if, on the contrary, it deviates to either side, it will not fail to place itself in the ischio-rectal excavation, as was observed in the case related by Scarpa, and then, in order to reach the viscera, it would be necessary to divide the skin, the very thick subcutaneous layer, the rectal lamina of the perineal aponeurosis, and the levator ani muscle, if they have not been separated or ruptured; a second cellular layer and the peritoneal sac.

The aponeurosis of the pelvis also presents some foramina for the passage of small veins or arteries, through which corpuscles of fat and nervous filaments also penetrate; but these apertures are too small to require much attention.

iv. *The Muscles.*

The *coccygæi* and *levatores ani* muscles here form a species of septum, of diaphragm, which is a perfect antagonist to the thoraco-abdominal septum. We have previously seen that they appertain principally to the perineal region. Be this as it may, the recto-vesical aponeurosis covers their pelvic surface, and the rectal lamina of that of the perinæum their external surface, so

that they are almost completely included in the interval of these two laminae; and as their fibres converge from the pelvic circumference to that of the bladder and intestine, it follows that, during their contraction, they raise the floor of the pelvis, and must tend to dilate the rectum rather than press upon the faeces, in order to urge them onwards.

The *pyriformis* is also contained in a kind of canal which is formed posteriorly by the anterior surface of the sacrum and of the sacro-sciatic ligaments, and anteriorly by the lamina of the pelvic aponeurosis; which canal is more or less elevated according to the volume of the muscle.

Lastly, the *obturator internus*, filling the whole of the obturator fossa, is in like manner included in a sac, constituted by the ischiatic fibrous layer of the perinaeum, by the lamina of the obturator, in the pelvis, and externally by the bones and the obturator membrane: so that during their action these last four muscles move freely in the osso-fibrous canals which contain them, without in the least interfering with the functions of the organs contained in the pelvic cavity.

v. *The Arteries.*

The arteries of the pelvis are numerous, and several of them of large size: with the exception of the arteria sacra-media, they all originate from the hypogastric or internal iliac. This trunk separates from the primitive iliac at the sacro-iliac symphysis, or rather, as we have seen, between this articulation and the sacro-vertebral angle, and almost always higher on the right side than on the left. It runs to the extent of an inch and a half or two inches before it gives off the pelvic arteries; so that the space in which a ligature may be applied upon it is very limited. It is then especially that it will be important to recollect that one is longer than the other, and that their relations are not exactly similar on the left and on the right. Thus, on both sides, the hypogastric (*internal iliac*) artery descends from the fossa iliaca obliquely forwards and inwards, forming a gentle convexity in the same direction, as far as the superior portion of the ischiatic notch. On the left side, it is situated between the sacra-media artery, which is internal and posteriorly, the ilio-lumbalis,

which ascends in the iliac fossa externally; the lumbo-sacral nerve, upon which it lies posteriorly and a little externally; the obturator nerve, which crosses its outer side nearly at a right angle, the ureter, which runs in the same manner upon its inner and anterior side, and the peritoneum, which covers the whole; but on the right, the corresponding vein is entirely on the outer side of the artery, whilst on the left it is at first situated behind it.

The deep situation of the internal iliac trunk, and the distribution of the branches which originate from it, would seem, at the first glance, to render its ligature impossible, on the one hand, and on the other, to prevent this operation from ever becoming necessary; such, however, in this two-fold view, is not the fact. Mr. S. Cooper informs us that Dr. Jeffray, of Glasgow, met with a case in which the glutæal artery was wounded, and the patient died from hæmorrhage; Theden, according to Scarpa, relates a similar example; on the other hand, John Bell was obliged to tie the artery of the muscles which fill the external iliac fossa in a case of this kind; and Dr. Stevens of Santa-Cruz, applied a ligature upon the internal iliac artery of the negress Maila, the 27th of December, 1812, for an aneurism of the glutæal branch, and it was attended with complete success.* The same operation was performed in a similar case, by Dr. Atkinson of York, May 12th, 1817, upon a man twenty-nine years of age; but he died nineteen days afterwards†. Consequently, if the obliteration of the internal iliac was the only resource that could be adopted for saving the life of the subject, we see that it is possible to accomplish it. It seems to us that by prolonging the incision, recommended by Abernethy in his later operations for securing the external iliac artery, upwards and outwards for an inch or two, we would easily reach the internal iliac without lacerating the peritoneum. We know, in fact, that this membrane is but very loosely connected to the contour of the pelvis and the internal surface of the *psoæ* muscles; therefore, by following with the index finger the inner side of the internal iliac artery and the superior strait of the pelvis from before backwards, as we approximate the sacro-vertebral we will surely meet

* Med. Chirurg. Trans. Vol. 5.

† Med. and Phys. Journal Vol. 38, etc.

with the trunk of the pelvic artery; as it is enveloped in the supple cellular tissue of the fascia propria, we might isolate it without difficulty from the ureter, the ilio-lumbalis artery, the lumbo-sacral nerve and even from the internal iliac vein; then, the obturator nerve, which there forms a species of cord easy to feel and distinguish, on account of its direction, would direct us so as to place the thread between it and the origin of the glutæal artery; for we conceive that it is of importance to apply the ligature as near this branch as possible, if we wish to place it at a proper distance from the bifurcation of the common iliac.

On a level with the great ischiatic notch the internal iliac spreads out, if I may so speak, into a number of branches, and first its glutæal branches, then the internal pudic, and afterwards the ischiatic penetrate above the aponeurotic arcade which converts the sciatic notch into a foramen, pass in the interval which exists between the nervous cords of the sacral plexus, and thus escape from the pelvis. The vesicales and hæmorrhoidales mediæ, which come off from the anterior part, remain behind the peritoneum, and descend flexuously in the fascia propria as far as the posterior surface of the rectum and bladder. The obturator artery, which originates on a level with the glutæal, or a little lower, takes its direction forwards, following the contour of the abdominal strait of the pelvis as far as the foramen obturatorium, and is only important on account of its anastomosis with the epigastric, and the part which it sometimes performs in crural and inguinal herniæ. As it lies against the wall of the pelvis, and as it penetrates into the external part of the obturator (*sub-pubic*) canal, it is evident that when herniæ protrude through this opening, the vessels will be situated upon the outer side of the neck of the tumour.

As to the ilio-lumbales and sacro-laterales they are unimportant in a surgical point of view, except when they originate a little higher than usual, and from the internal iliac (*hypogastrique*), in which cases they will interfere more or less in the application of the ligature upon this trunk.

VI. *The Veins.*

They are much larger and more numerous than the arteries ; are distributed in the same manner, possess valves, which prevent their being injected from their common trunk ; and their coats are very thin ; so that if we do not pay great attention when we are attempting to secure the internal iliac artery, we may easily perforate them and thereby occasion a considerable extravasion.

VII. *The Lymphatics.*

This system is very abundant in the cavity of the pelvis. The glands surround almost all the principal arteries, are found especially behind the rectum and near the ischiatic notch, around the trunk of the internal iliac, and frequently we find one or more of small size in contact with the obturator artery and nerve, previous to their entrance into the sub-pubic canal ; finally, with the lymphatic vessels, they constitute a very complicated plexus, which becomes engorged in consequence of deep-seated diseases of the extremities, suppurations for example.

VIII. *The Nerves.*

They consist of two orders ; those of the first, appertaining to the great sympathetics (*triplanchiques*), are very delicate, form the hypogastric plexus, and are distributed principally to the bladder and intestinum rectum ; from which circumstance these two organs are not completely under the control of the will. Those of the second, *spinal*, form the sacral plexus, and give off the obturator nerve, which runs in a direct line from the sacro-vertebral angle to the sub-pubic hole, whilst the artery follows the curvature of the pelvic circle ; the sacro-lumbalis nerve, which descends upon the wing of the sacrum and the fore part of the sacro-iliac symphysis ; the sacral plexus, which is formed by the union of the last spinal nerves ; this plexus is situated upon the anterior surface of the pyriformis muscle, and passes above the fibrous arcade of the ischiatic notch in its way to the hip, so that

a tumour or any other compressing cause, acting upon the posterior inclined plane of the pelvis, may produce paralysis or at least numbness of the posterior part of the inferior extremity. It also results from this disposition that the superior ischiatic notch is completely filled by the sacral plexus and the three principal branches of the internal iliac artery. Nevertheless, the cases related by Papen,* Verdier,† Camper,‡ Bose,§ A. Cooper, Lassus, etc., prove that the intestines may escape through this opening and form a considerable hernia at the margin of the anus, so that it would not always be easy to distinguish it from perinæal hernia, with which it appears that it has been more than once confounded.

IX. *The Bladder.*

Having examined the neck of this organ when treating of the perinæum, all that we have to describe here is its body and its summit, or its superior portion. Posteriorly this pouch is separated from the rectum by the recto-vesical excavation; in this direction the peritoneum is very intimately united to it. Anteriorly, it is applied against the symphysis pubis in such a manner, that, in the operation which consists in making a section of this articulation, it would be easy to wound it, and that, in cases where there is a separation or congenital absence of the symphysis, it may project under the skin, as has been observed by Professor Chaussier.|| It is this portion of the bladder which presents the most interest in surgery, on account of hypogastric lithotomy. It is not covered by the peritoneum, so that we may at all times, whenever it rises above the pubis, extract through it calculi which are of too large a size to be brought out by the perinæum. In fact, the peritoneum which lines the posterior surface of the recti muscles, separates from them as it approximates the pubes, for the purpose of reflecting itself upon the summit and posterior surface of the bladder; so that a more or less extensive portion of the fore part of this reservoir is found uncovered behind the inferior extremity of the muscular parietes of the belly, from

* Haller, *Thèses choisies*, tome 3. † *Mémoires de l'académie*, etc. ‡ *Demonstrat. anat. path.* lib. 2. § *De Enterocœle ischiadice* (Lips. 1772). || *Bullet. de la Faculté de Médecine* 1818.

which it is then separated only by the adipo-cellular tissue which fills the small supra-pubic fossette, which we pointed out when on the hypogastric region. If the bladder always rose above the level of the brim of the pelvis, the lithotomy by the high operation, such as was practised by Franco, would perhaps be the least dangerous of all; but this is not the case: in the state of vacuity, it is constantly below this border, and of this Rousset and Douglass were well aware when they advised the precaution of filling it with a fluid in order to distend and cause it to ascend as far as was necessary: it is then only when it is filled with urine or some other liquid, that it actually separates the peritoneum, in order to ascend between it and the muscles, above the symphysis pubis; and the surgeon should never attempt to attack it without having previously placed it in this position, either by obliging the patient to retain his urine for several hours, as recommended by Cheselien, Probi, Morand, etc.; or, what is still better, by the method of Frère Cosme, that is to say by raising it with the extremity of a catheter, which we slide upon the anterior paries of its cavity, pressing it sufficiently against the posterior surface of the symphysis, in order to prevent the folding of the bladder and to avoid the risk of transfixing the peritoneum; but, notwithstanding all these precautions, it is not always possible to raise the reservoir of urine so much above the pubis, that it may be opened without danger. Indeed, it is well known that in old men and the majority of calculous individuals, that the bladder is contracted and retracted to such a degree that it is entirely buried in the pelvis; frequently also its coats are so much thickened, and the organ has lost the habit of dilating for so long a period, that it becomes totally impossible to distend it. We have even this day examined, in the pavilions of the *Ecole Pratique*, the bladders of fifteen subjects, and in seven only were we able to reach the bladder above the pubis without wounding the peritoneum. Consequently, the operation of lithotomy above the pubes cannot be generally adopted, and in order to perform it, it is necessary as a first step, that the bladder should be so supple as to admit of a proper degree of dilatation from the urine and of being raised by means of instruments. Although this operation, under the most advantageous circumstances, is far from being a harmless one, yet it must not be supposed that it is so uniformly dangerous

as some surgeons imagine ; for Dr. Souberbielle has for a long time practised it almost exclusively, and with as much success as is obtained by the lateralized method. Whenever the bladder is sufficiently extensible or dilatable to admit of its being sufficiently elevated, several modifications have been proposed, with the view of rendering this operation more advantageous. That of Sir E. Home, in which the incision *in perinæo* is omitted, because the same end may be attained by introducing a catheter by the urethra ; that of Scarpa, which is perhaps still more important ; and indeed by the method of Frère Cosme, an incision three inches in length having been cautiously made immediately above the pubes, in the track of the median line, through the skin, the fibro-cellular elastic layer and the linea alba, separating the pyramidales and recti muscles and the cellular tissue of the *suprapubic fossette*, the dart of the catheter (*le dard de la sonde*) was pushed by the assistant in such a manner as to perforate the bladder, in order that a bistoury might be guided along the groove in its concavity for the purpose of dividing from above downwards the anterior paries of the urinary cyst to near its neck : frequently, however, the latter incision was scarcely begun before the *sonde à dard* passed through the opening by which the stylet (*flèche*) had escaped, and from this moment the bladder was no longer supported. It is this inconvenience that the modification recommended by Scarpa is intended to remedy. In the first place, the extremity of his sound (*algalié*) is much larger than that of Frère Cosme and of an olive shape ; next he seizes hold of this portion of the instrument with the thumb and index finger including the coats of the raised bladder in the gripe, after being well assured that the peritoneum does not cover it at this point ; it is then only that he propels the *flèche*, and afterwards, instead of sliding the bistoury along the groove of this *dard*, in order to enlarge the opening through which it has passed, Scarpa perforates the urinary reservoir two or three lines lower than the part traversed by the stylet, into the groove of which the bistoury does not enter until it has passed into the cavity of the bladder ; so that this pouch always remains supported in a solid manner by the sound. The third modification has not yet been laid before the public ; it appertains to M. Pinel Grandchamp, and we derive our knowledge of it from Dr. Ollivier of Angers. M. Pinel

has just presented to the Royal Academy of Medicine a work in which, in consequence of a great many experiments made upon living animals, he comes to the conclusion that even very extensive wounds of the bladder may be completely and promptly cured by re-uniting the lips by means of suture ; so that, for example, after lithotomy above the pubes, we will surely avoid the callous state of the edges of the division and the suppuration which results from it, as well as the infiltration or extravasation of the urine into the cellular tissue, by immediately uniting, not simply the wound of the parietes of the abdomen, but also, and very exactly, that of the bladder. Not having been led to examine the facts upon which this opinion is founded, nor the reasons brought in support of it by the author, we dare not undertake either to dispute or approve it, and we only give it by anticipation.

Upon the sides, the bladder presents nothing remarkable, as it regards its relations : the peritoneum there covers it entirely and also adheres to it pretty firmly.

Taken in its *ensemble*, the bladder is usually directed from above downwards, having a slight inclination from the right to the left ; for which reason it is most proper to choose the left side of the perinæum when we perform the operation of lithotomy by the lateralized method. In children, the bladder is naturally more elongated ; it approximates more to the umbilicus, and does not dive so deep in the pelvis ; hence, in them, lithotomy above the pubis presents more chances of success than in adults ; it is continuous in a more evident manner with the urachus, and curves a little less in order to pass under the pubic arch ; its *bas-fond* then scarcely exists ; it possesses very great extensibility, and during several years it is, as it were, placed without the pelvis, and promptly projects the hypogastrium when distended.

The mucous membrane of this organ is very thick and contains but few follicles ; notwithstanding it secretes mucosities in great abundance, and so much so, that, in what was formerly called catarrh of the bladder, the urine of the patient deposits a greater or less proportion of a thick, ropy, oleaginous and very tenacious matter ; a matter which Sir E. Home thinks is furnished by a diseased prostate. without, however, founding his

opinion on very plausible data.* It frequently becomes fungous, covered with granulations, and with inequalities in those who have long carried one or more stones in the bladder; it also forms wrinkles, against which the beak of the sound or catheter sometimes strikes; which might lead to the supposition of the existence of a calculus.

The muscular membrane is formed of fibres disposed in various directions; some are annular, and are so closely approximated, superiorly, that they have been considered a distinct muscle, designated by the name of *detrusor urinae*: others are oblique; but the greater proportion form arches, and follow the direction of the great axis of the organ. It is not unusual to see the latter collected in columns, in parallel fasciculi, between which the peritoneal and villous tunics are in immediate contact: sometimes these fasciculi are also intersected at different angles by other fleshy bands, which are produced by the approximation of the circular or oblique fibres; so that in these columnar bladders, (*vesies à colonnes*,) calculi very easily form *culs-de-sac*, in which they are, as it were, imprisoned. The bladder may then have a greater or less number of appendages, constituting as many herniæ, each containing a stone, which, in this case, is called *encysted*. It is not meant by this, however, that whenever encysted calculi exist this disposition is present; the researches of Houstet, Garangeot, Lafaye, Desault, etc., demonstrate that sometimes these foreign bodies are simply adherent to the internal surface of the bladder, and covered in part only by the mucous membrane swollen or folded around them. Fr. Meckel says, that he has even seen them enveloped completely, notwithstanding there was no lateral excavation, and he thinks that, in this case, the cyst of the calculus is entirely formed by the organization of the mucus.

As the cavity of the bladder is more depressed in its fundus than the commencement of the canal of the urethra, it is necessary to elevate the handle of the sound considerably, and incline it to the right, left, and in every direction, when we are endeavouring to ascertain the presence of a stone. This cavity of the bladder being very variable in its dimensions, according to its state of plenitude or vacuity, to its healthy or diseased condition, to the

* Treatise on the Diseases of the Prostate.

habit, age, sex, &c., of the patient, being, nevertheless, always more or less inclined downwards and backwards, it follows that the *lithotome cache* does not wound its parietes so frequently as might at first sight be apprehended, although this accident is not very unfrequent, especially in early life: as this species of excavation is likewise less deep in children, the gorget or bistoury are perhaps preferable in them to other instruments. As, on the other hand, when the rectum is filled with fæces, it causes it to disappear more or less completely, we should never omit evacuating this intestine a few hours previous to the operation, when it is to be performed below the pubis. Finally, it is to be recollected that the bladder never dilates but at the expense of its thickness, so that, when it is distended in such a manner as to rise very high in and above the hypogastrium it becomes extremely thin, and that it would be very easy to rupture it by making some effort, or indeed by pressing, in any manner whatever, upon the abdomen. On the other hand, when it contracts in such a manner as in a great measure to obliterate its cavity, as sometimes happens when it contracts upon calculi, its walls become so thick, under certain circumstances, as to present a thickness even of several inches; and, what is very remarkable and important to note is, that it is large calculi particularly which determine this contraction and this thickening of the bladder: whence it follows that the hypogastric lithotomy, instead of being applicable for large stones, for which certain surgeons have reserved it, is much less suitable for them than for those of smaller volume.

X. *The Rectum.*

It extends from the left side of the sacro-vertebral angle to the anus, and is the continuation of the sigmoid flexure of the colon. Its direction is such that it presents two distinct curvatures; one, which is moulded upon the anterior surface of the sacrum, and the other occasioned by the oblique descent which the rectum at first makes from the left to right until it reaches the median line, sometimes even passing a little beyond this, in order that it may again incline very slightly to the left. As this organ is very moveable above, it follows that it occasionally passes considerably upon the right side, and hence, doubtless, the assertion of some modern anatomi-

mists, which is in opposition to what was always supposed to be the fact, that the rectum is as often or more frequently upon the right than the left of the median line. We have examined this portion of the intestinal canal in a great number of subjects, and we have not only very seldom met with this species of transposition, but also have most frequently found it resting upon the fore part of the sacro-iliac junction of the left side, and arriving upon the middle of the sacrum in its inferior portion only, so that its lateral curvature was, in general, but slightly developed.

The anterior concavity extends to a level with the prostate, in the perineal region, from which point its direction changes so that it becomes concave posteriorly, as has been previously noticed. The rectum becomes more and more fixed in proportion to its descent, because the mesenteric duplicature which attaches it posteriorly disappears at its inferior part. Its anterior concavity is much increased by the collapsing of its parietes, and as this curvature receives the posterior paries of the bladder, we conceive that when the former organ is in a state of repletion it must necessarily push upwards and forwards the *bas-fond* of the bladder. In cases where the intestine remains habitually dilated, its tunics become so much attenuated that the viscera, protruded into the *recto-vesical cul-de-sac*, may separate its fibres and form a hernia in the rectal cavity, instead of sliding between the prostate and rectum in order to constitute a perineal hernia. As the anterior, as well as the lateral portions of this organ, support a considerable number of floating *appendices epiploicæ*, it may happen that the loose extremity of one of them may become agglutinated to some other point of the peritoneum, thereby forming a ring into which a loop of intestine may insinuate itself and even become strangulated: examples of which have occurred.

At the interior, the rectum presents nothing different from what is observed in its perineal portion: its mucous membrane is wrinkled in the same manner, and contains a considerable number of the follicles of Brunner, which are likewise found throughout the whole extent of the large intestine. As these follicles are diseased in a great many phthisical persons, may we not presume that they thus become the cause of the stercoraceous fistulæ so often observed in these patients? As they likewise ulcerate in the greater proportion of those fevers called *atariques*

and *adynamiques* with diarrhœa, may they not in the same manner favour stercoral phlegmons at the margin of the anus? And if, the fistula being established with a more or less abundant suppuration, it was demonstrated that the morbid secretions may be taken up by the absorbents and re-conveyed in greater or less quantities into the general circulation, would we not have some reason to infer that pulmonary consumption, or other deep-seated disorganizations which sometimes follow the establishment of these kinds of fistulæ in individuals apparently the most healthy, are only consecutive, are, in fact, an effect and not the cause?

As to the muscular coat of this intestine, it is very thick and very strong, since all its fibres are longitudinal, and they occasion the rectum to assume a contracted appearance in this portion of its extent.

Finally, we also find in the pelvis a portion of the ureters and of the vasa deferentia, disposed in such a manner, that the former descend obliquely, crossing the iliac vessels under the peritoneum, and follow the side of the *recto-vesical cul-de-sac*, in order to reach the sides of the *bas-fond* of the bladder; that the latter descend obliquely also, from the abdominal aperture of the inguinal canal to the posterior part of the prostate, crossing the external iliac vessels, behind the origin of the epigastrics, and the posterior surface of the ureters; so that at their point of intersection these four cords are included in the thick and very dense fascia propria which lines the external portion of the ring (*collet*) which limits superiorly the recto-vesical excavation; whence it follows that they may evidently be compressed by the intestines squeezed into this cul-de-sac, and that, in some cases, to this cause may be attributed the enormous dilatation which they sometimes undergo. Finally, in speaking of the arteries we noticed the precautions which should be taken when we are about to apply a ligature around these vessels.

The *Skeleton* of this region presenting but little surgical interest in the male, we will examine it in the female only.

With respect to the order of superposition, we will consider it in two different directions; viz. from before backwards, and transversely.

In the first we find, 1st, an abstraction being made of the parts which compose the pubic region, a supple, sometimes adipose, cel-

lular tissue, and making a part of the fascia propria; 2d, the anterior paries of the bladder, which increases in thickness the nearer we approach the neck of this reservoir; 3d, the vesical cavity; 4th, the posterior wall of the same organ, mantled posteriorly by a peritoneal layer; 5th, the *recto vesical cul-de-sac* (excavation), in which a portion of intestine is usually contained; 6th, the fore part of the rectum, also covered by the peritoneum; 7th, the cavity of this intestine; 8th, its posterior wall, completely enveloped by the serous membrane superiorly, and separated inferiorly from the anterior surface of the sacrum by the cellular layer only; 9th, this cellular layer, enclosing in those of its lamellæ which are nearest to the intestine inferiorly the hæmorrhoidal arteries, and some lymphatic vessels and glands throughout its whole extent; 10th, the arteria sacra media and the arteriæ sacrae laterales; 11th, the sacrum.

In the second we see, from one of the sides of the cavity of the pelvis to the other, 1st, the pyriformis, obturator internus, coccygæus, and levator ani muscles; 2d, the aponeurosis, comprising the lamina of the obturator anteriorly, that of the pyriformis posteriorly, and presenting the ischiatic notch and obturator foramen, at the upper part of which herniæ of the same name protrude; 3d, the internal iliac artery and all the branches originating from it, the sacral plexus, the lumbo-abdominalis and obturator nerves; the vas deferens, ureter and lymphatic glands: all these organs are included in the fascia propria: 4th, the peritoneum; 5th, the sides of the bladder and of the rectum covered by the abdominal serous membrane; 6th, the cavity of the urinary reservoir and that of the organ of defecation, the *recto-vesical cul-de-sac* between these two organs; then, on the other side of the median line, the same parts in an inverse order.

Sec. 4. Of the Perinæum in the Female.

In this sex we find much the same parts as in the male, but, for the most part, they present certain characters which should not be passed over in silence. The perinæum of the female also comprises all of the external organs of generation, and not the urethra simply.

The following are the average dimensions which we have obtained from a greater number of subjects :

From the summit of the pubes to the clitoris, two inches and a half.

From the anterior commissure to the vulva of the anus, three inches and a half.

From the clitoris to the posterior commissure of the os externum vaginæ, one inch and a half.

From the posterior commissure of the vulva to the apex of the coccyx, three inches ; so that from the coccyx to the anus we find about nineteen lines.

From the anus to the vulva, sixteen lines, and the remainder for the aperture of the rectum. The transverse measurements will not afford interest except upon the skeleton. But let us first pass in review the different soft parts.

1st *The Skin.* It is a little less moveable and less fine than in man, and we find in it a smaller quantity of hairs, especially behind ; in folding itself inwards in order to form the labia pudendi, it loses its cutaneous characters and assumes those of mucous membranes, so that from the internal surface of these duplicatures hairs do not originate, and the sebaceous secretion is of a nature somewhat different, but more abundant ; this secretion frequently becomes depraved, acrid, and irritates the parts upon which it accumulates, so that in persons of uncleanly habits it sometimes gives rise to a discharge, which has been mistaken for gonorrhœa. Further, the labia form two species of crests which are firm and rounded previous to puberty, becoming more or less soft, flaccid and elongated in married females ; between these crests and the thigh there is a groove, in the bottom of which we feel the ischio-pubic ramus. Between the superior half of their internal surface and the nymphæ we observe a triangular space which unites with a similar space of the opposite side, above the clitoris ; the nymphæ themselves, which are merely a fold of the integuments, are proportionately much more elongated in very young girls than after puberty ; but in the latter, they may accidentally acquire such an additional length as to interfere with copulation and require excision. According to Perron and Lesueur, the nymphæ of the *houzwâanases* and *boschimanes* women, at the south of the Cape of Good Hope, are about seven or eight

inches in length, and constitute what is called the "*apron of the Hottentots*." It is true that Le Vaillant is not of the same opinion; that the jesuit Tackard described this apron as a simple duplicature of the skin, and that Salzmann denied its existence, affirming that travellers have been deceived by the factitious apron uniformly worn by these women. Let these different statements be as they may, it is certain that the *Hottentot Venus*, delineated by M. Flourens in the *Journal Complementaire du Dictionnaire des Sciences Médicales*, presents this singular prolongation of the nymphæ, and that among the women of Africa and Asia, these organs are very often of such an inconvenient length that the excision of a portion of them frequently becomes necessary in order to facilitate cohabitation. In the perinæum properly so called, the skin resumes the same characters which appertain to the male, and equally presents a raphé upon the median line.

2d. The *Subcutaneous Layer* becomes very thick upon the labia and nymphæ, and is intermingled with vessels, nervous filaments and adeps, forming a thick, elastic, erectile and pretty compact cushion, in which phlegmonous inflammation is pretty frequently developed, attended with acute pain, and rapidly running into suppuration; so that a vigorous method of treatment is required, either by the application of numerous leeches from the commencement, or making an early opening, when pus has formed, if we wish to prevent an extensive and very prompt burrowing under the integuments.

3d. The *aponeurosis* presents, in addition to what exists in the male, a large aperture which circumscribes the vulva, and this fascia, which supports the perinæum in the female is sometimes so strong as to occasion great resistance during parturition by opposing the dilatation of the os externum, and also to hinder the introduction of the hand into the vagina, especially in women who are in labour for the first time.

4th. The *muscles* are the same, as it respects the ischio-coccygæus, ischio-cavernosus, and levator ani; but the sphincter ani and the bulbo-cavernosus are a little different. The sphincter ani in fact, is so disposed, that the anterior extremity of its two lateral halves are very evidently interlaced, in many females, and is directly continuous with the transversalis perinæi muscle.

which then seems to be merely an appendage to it. This disposition, which we have met with very frequently, has been accurately represented in the elegant plates of Tiedemann, upon the arteries. The *bulbo cavernosus** forms an additional sphincter moulded upon the vulva, which it embraces, and in such a manner that its two portions are enclosed in the *labia pudendi*; so that when in action the curvature which they make tends to disappear, thereby contracting more or less the *os externum vaginæ*.

5th. The *arteries*, are, proportionally, smaller than in the opposite sex; the inferior or external hæmorrhoidal is nearly the same as in man; the transverse perineal artery, however is of much less magnitude. The superficial artery is distributed to the *labia*, and its calibre is too inconsiderable to occasion a dangerous hæmorrhage when divided. Finally, the internal pudic artery is so small as it approximates the summit of the arch of the pubis, that it deserves no particular attention: therefore, in performing the operation of lithotomy upon the female by the lateral, transverse or lateralized methods, it is not hæmorrhage that we need apprehend, unless we should carry the bistoury to the principal trunk; but this is so remote from the median line that we are never obliged to extend the incision thus far; there are other anatomical reasons however, which do not permit us to cut in this manner upon females.

6th. The *Veins*; 7th. the *Lymphatics*; 8th. the *Nerves*; do not present any thing requiring special consideration.

9th. The *Urethra* is very remarkable for its shortness, extensibility and structure; its length varies from ten and a half to fifteen lines; it is conical and susceptible of very great dilatation: whence it follows that very large calculi may traverse it spontaneously, and thus escape from the bladder. Heister, Middleton, Colot, Molineux, Yelloly, Sir A. Cooper, have related instances in which stones of two, three, and even four ounces have been expelled from this canal by its organic action alone. It is in consequence of this well known property of the urethra that Tolet first, afterwards Bromfield, and many others have proposed making use of artificial dilatation in preference to incision, for the purpose of extracting these foreign bodies; and we may now

* *Constrictor vaginæ*.—*Transl.*

predict that, if ever the lithontriptic instruments of MM. Amussat, Leroy, Civiale, become of general application, it will be principally in female cases. Being enveloped only by an erectile layer, of but slight thickness, and not by a prostate, the urethra in this sex, is in fact merely a simple prolongation of the bladder; its anterior surface is slightly concave, so that a catheter almost straight will very readily pass through it; but, during pregnancy, it is so much raised against the posterior part of the symphysis pubis that it becomes, so to say, almost perpendicular; whereby it becomes necessary to use an instrument very much curved in order to arrive at the urinary reservoir; and it is likewise flattened to such a degree in these cases, that the English have for a long time given the flat catheter the preference to the cylindrical one. Its interior presents no verumontanum, prostatic sinus, nor valvular fold; superiorly, it is separated from the pubic arch by an interval of four or five lines, and remains at the same distance from the inferior surface of the clitoris: so that between the latter organ and the meatus urinarius there is a triangular fossette, which is bounded laterally by the nymphæ.

From this fossette to the neck of the bladder, in passing below the pubes, we find; 1st, the mucous membrane; 2d, a dense cellular layer enclosing some vessels and the prolongation of the constrictor vaginae muscle; 3d, the superior portion of the perineal aponeurosis, in the laminae of which we find the termination of the internal pudic artery; 4th, a supple, extensible cellular tissue, and nearer the canal of the urethra a layer of erectile tissue; 5th, the anterior part of the neck of the bladder. These are the parts which from the time of Celsus, surgeons have divided for the purpose of extracting calculi from the bladder of the female.* * * * *

*Mulieri verò inter urinæ iter et os pubis incidendum est sic, ut utroque loco plaga transversa sit neque terri convenit, si plus ex muliebri corpore sanguinis profluit;** and such is the route which M. Lisfranc has recently proposed to follow in the same operation. In order that the advantages of his method may be duly appreciated, this dexterous surgeon observes that the transverse dimension of the pubic arch, at the middle of its height, is about two inches

* *De re medicâ*, lib. vii, cap. iii, sect. ix. page 437 édit. de Vatar.

and a half, and that the canal of the urethra may be depressed thus far, by pressing upon its inferior paries with the staff, after having divided by a semi-circular incision all the layers which separate the vestibule from the neck of the bladder, and, consequently, that it is possible to extract calculi of the largest size, through this opening, without danger. It is true that we surely avoid the vagina; that the internal pudic artery which will frequently be divided, is too small to occasion a serious hæmorrhage; that we leave the canal of the urethra entire, so that we need not apprehend incontinence of urine, and that it is not very difficult to perform this operation upon the dead body; but it is necessary to detach the soft parts completely from the pubic arch, so that the semilunar flap which includes the urethra being alone moveable, it tends to remove from the osseous arch. If we divide the bladder parallel to its fibres, behind the pubes, it will be difficult to profit by the great extent of the external wound; and if, on the contrary, we cut the vesical neck transversely, we will have reason to apprehend the persistance of an urinary fistula, in consequence of the natural retraction of the fleshy fasciculi; and in either case, it is very probable that the urine will occasionally exude, in greater or less abundance, into the very lax cellular tissue which exists between the pubes and the neck of the bladder.

Moreover, we well know how dangerous wounds of this reservoir are in man, when the incision, in lithotomy, is prolonged upon its parietes beyond the prostate gland; so that it seems, *à priori* that the Celsian lithotomy, according to the much more rational process of M. Lisfranc, must be attended with dangers so serious as to counter-balance its advantages. In fact, by dividing the whole length of the urethra at its superior paries, with a simple bistoury conducted upon a grooved director, or with the *lithotome caché* of Frère Cosme, as advised by MM. Dubois and Dupuytren, we may obtain an opening of an inch and even sixteen lines, because it may be prolonged without any kind of danger to the sub-pubic ligament. By this method then, together with the additional room gained by the dilatation of the soft parts, we may extract calculi of six, eight, ten and even twelve lines in diameter. Besides, when the operation has been performed with every necessary precaution, the wound cicatrizes very well, and incontinence follows less frequently than some

surgeons have intimated. Now, whenever calculi are of a more considerable volume, we think that it would be more dangerous to extract them by M. Lisfranc's method than by the operation above the pubes.

The neck of the bladder and urethra not being surrounded by a voluminous gland as in man, it follows that this canal is only separated from the vagina by a thin layer of dense and compact cellular tissue, and that we may penetrate with the greatest facility into the bladder by the vulvo-uterine canal. It is also pretty evident that, if the recto-vesical operation of M. Sanson is likely to prove successful in man, the lithotomy by the vagina would be still more advantageous, whether we operate after the method of Rousset, F. de Hilden, Méry, Tollet; or according to MM. Clemot, Flaubert, etc., for here there are no vesiculæ seminales, no vasa deferentia, nor ejaculator canals. The venous plexus also is of much smaller volume; but vagino-vesical fistulæ are still more difficult to prevent than those of the rectum; which is probably owing to the bladder being destitute of a solid body like the prostate, which might keep the lips of the wound approximated by counter-balancing the action of the muscular fibres. After all, it appears that, if the bladder was kept in a constant state of vacuity, we would succeed in curing these fistulæ; at least some attempts made at the hospital St. Louis by M. J. Cloquet with his *sonde à double courant*, would lead us to suppose so, and the anatomical disposition alone would dispose us to predict it, because by this means the two lips of the division are in contact, and no longer in a state of constant mobility. This contact is, in fact, indispensable in order to obtain a perfect cure, and Prof. Lallemand of Montpellier has rendered an essential service to the science in this respect, by inventing a species of double hook (*double érigne*) with which he has succeeded in obtaining a complete union.

From these relations of the bas-fond of the bladder, of the urethra and of the vagina, it follows that when we endeavour to divide the vesical neck obliquely downwards and outwards, whether by operating in the same manner as in man, as was done by Frère Jacques, or by introducing the *lithotome cache*, by the urethra, for the purpose of dividing the canal at the same time in the same direction, as advised by Frère Cosme, and as has since been

practised by many surgeons, it will be very difficult to avoid the vagina, be it ever so little dilated. Besides, in married women of a certain age, and in those especially who have borne children, the anterior part of the vagina is, so to say, grooved out for the reception of the urethra, so that if we divide the latter, even exactly transversely, we will not always be sure of avoiding the former, whether we make use of the enormous lancet, advised by Louis, which was driven from before backwards in a sheath or case, by which both sides were cut simultaneously; or whether we employ the same instrument with but one cutting edge, as modified by Leblanc, or the *uretrotome* of Lecat; or prefer the double bladed *lithotome caché* used by Dupuytren in the transverse lithotomy in man, and which Fleurant of Lyons proposed. It is, nevertheless, proper to note, that previous to puberty, the vagina is so narrow that it will admit of the application of the most of these methods, if, on the other hand, the double or simple division of the urethra was not formidable on account of the incontinence of urine which is sometimes the consequence of it. In all these cases we see that the process of Frère Jacques, or the lateralized method, would be to these lateral or oblique divisions of the urethra, what the process of M. Lisfranc, or the transverse lithotomy is to the incision of the superior paries.

The Meatus Urinarus, much narrower than the rest of the canal, is separated from the vulvar opening of the vagina by a more or less prominent tubercle, which deserves attention when we wish to introduce the catheter without exposing the female. This tubercle may be readily felt by sliding the pulp of the middle finger upwards from the fourchette towards the vestibule; so that when we have detected it, it is sufficient, in order to penetrate into the urethra, to slide the catheter, previously held like a pen, upon the extremity of the finger which directs it.

10th. The *Vagina* is an organ which has nothing analogous to it in the perinæum of the male. In women who have had children we generally find four tubercles, usually situated upon the extremities of the vertical and transverse diameters of the vulvar orifice, which are called *carunculæ myrtiformes*; the anterior and posterior are nothing more than the terminations of the two corresponding columns of the vaginal cavity; the two lateral ones are owing to the retraction of the flaps of the ruptured hymen:

it is necessary to know these organs that we may avoid mistaking them for syphylitic warts. At birth, and until puberty, unless destroyed by accident, this opening is contracted posteriorly by a semilunar fold, called *hymen* or vaginal valve, the concave margin of which is directed forwards. This membrane is generally torn during the first attempt at cohabitation, and often even previous to puberty in consequence of some sudden motion, etc.; but at other times it so strong and broad, that it closes in great part, or even entirely, the vagina; whereby the discharge of the catamenia is rendered difficult, if not impossible; so that an incision becomes necessary in order to relieve the symptoms produced by the retention of the secretion accumulated in the vagina. Indeed, it has also been found so strong and unyielding as to prevent copulation, yet admit of fœcundation, persisting until the period of parturition and opposing the expulsion of the fœtus, so that the surgeon has been obliged to divide it; an operation twice performed by A. Paré. It is sufficient to mention such cases in order to show that the presence of this membrane does not prove the innocence of the woman, even as its absence is no proof against the purity of her manners. Finally, the hymen sometimes contains muscular fibres; at other times it has the appearance of a simple horny lamina; but it never contains large vessels.

The interior of the vagina is remarkable, especially for the numerous rugæ which we find within it; these rugæ, the nature of which has not as yet been sufficiently examined, consist of two orders, one of which is parallel to the direction of the canal, the other oblique.

The former, only two in number, one anterior, the other posterior, are very apparent as they approximate the bladder, but gradually disappearing as they ascend towards the neck of the uterus, often become swollen during pregnancy, and even when the womb is in a state of vacuity, to such a degree as to embarrass persons who have not reflected upon this peculiarity. As they seem to result from the conjunction the two halves of which the vagina is primitively formed, we conceive that they may produce a more or less considerable projection, each representing a species of crest; which may even come in coaptation with one another, become agglutinated by their free border, and

thereby form a complete septum; whence it follows that the cases of a vagina with a double canal are by no means wonderful.

The second, soft and supple during pregnancy, but much denser in those who are not pregnant, when they produce the sensation which is experienced from passing the finger upon the palatine arch of a ruminant animal, leave furrows between them, in the bottom of which syphylitic ulcerations are frequently concealed; so that an attentive investigation is sometimes necessary in order to detect these diseases in this sex.

In consequence of the relations of the vagina with the bladder, it sometimes happens during parturition, when the pelvis is narrow, the pains violent, and the labour tedious, that the head of the child may contuse the vesico-vaginal septum to such a degree as to determine the formation of an eschar, which, on being thrown off, will leave a fistulous opening. If we have decided on operating for lithotomy, or simply puncturing the bladder from the vagina, it will be well to recollect that the peritoneum does not, in general, descend further than on a level with the junction of this canal with the neck of the uterus, and that this membrane is rarely prolonged between the vagina and the bladder; so that, so far as the peritoneum is concerned, we may operate without fear.

Posteriorly, its relations with the rectum are also very important. These two organs are at first only separated from each other by a simple cellular layer, which gradually becomes thinner and more compact as it descends; and, from this simple application, results the recto-vaginal septum. Against the concave part of this septum the head of the child bears very firmly, when it is passing through a pelvis the sacrum of which is very much curved, so that this partition is sometimes torn during parturition, and the child comes out by the anus; or, an eschar simply is formed, which, on being thrown off, leaves a recto-vaginal fistula. As the rectum, when it reaches the anterior surface of the coccyx, curves backwards, in such a manner as to present a convexity forwards, and as the vagina, on the contrary, descends regularly in the direction of the axis of the inferior pelvic strait, they consequently diverge from one another, leaving between them a triangular space, which is bounded anteriorly by the posterior surface of the vagina; posteriorly, by the anterior surface of the rectum,

and, inferiorly, by the skin which extends from the vulva to the anus. This triangle is filled with fat, a filamentous and lamellated cellular tissue, by some fibres of the transversalis and sphincter, constrictor vaginæ and levator ani muscles, by some twigs of the transversus perinæi artery, and by a portion of the erectile layer (*plexus retiformis*) which surrounds the lower part of the vagina. It is the base of this space which becomes greatly elongated when the child's head is about to escape from the inferior strait; all the layers in this triangle become flattened, yield, distend, and soon the perinæum of the female is drawn out to the extent of three, four, or even five inches; so much, indeed, is it lengthened that the head of the infant may lacerate and pass through it, without rupturing either the posterior commissure of the vulva, or the anterior margin of the anus. We already possess several cases of this kind; and, what is most surprising, these enormous lacerations usually heal promptly and in a solid manner.

In the spring of 1824 we were called to Madame B——, who had been in labour twelve hours. When we arrived, we found the midwife supporting the perinæum with all her strength, with her two hands placed over one another, and over these the hand of a nurse and that of the husband. This scaffolding being removed, we perceived that the whole of the cranium of the child had already perforated the perinæum, the anterior border of which was entire; we thought that the head was in the anus; but as soon as the infant was expelled, we were soon convinced that this opening was entire also; twenty days afterwards this lady was perfectly cured. In the month of August, 1825, she was again delivered without any accident and without assistance; for we did not arrive near her until after the child was born. At present she is very well.

The parts which envelope the sides of the vagina, are the same as those which are in relation with the rectum and bladder in the male. Finally, between the posterior part of its orifice and the perineal commissure of the vulva, we observe the fossa navicularis and the fourchette, which are lacerated, or disappear by dilatation during parturition, but so that we need scarcely pay attention to these kinds of lacerations unless they equally involve a more or less extensive portion of the perinæum, properly so called.

When the perineal aponeurosis, which is perforated by the vagina, as well as the other layers which enter into the composition of this region, present, less resistance than usual, or are in a relaxed state, it sometimes happens that the vagina becomes inverted, and that the neck of the womb then descends to the vulva, constituting a prolapsus uteri. It may also happen that, while in this state, the os tincæ becomes elongated to a very unusual degree, as has been observed by Prof. Lallemand, of the Salpêtrière, and Bichat, and such elongations, when the knowledge of anatomy was not so correct as at present, have been mistaken for the penis, and considered as cases of hermaphroditism, as is proved by that of Marguerite Malaure, related by Saviard. When the womb is prolapsed and we wish to introduce a flat pessary, it is necessary, in order that it may be retained, to recollect that we may give to these instruments sufficient breadth transversely, to admit of their being supported by the ischia, and when once fixed in this situation, they will be retained by the whole floor of the perinæum, and especially by the aponeurosis, which is only an expansion of the *productio fulciformis* of the great sacro-ischiatic ligament; whilst, from before backwards, the bladder and rectum will not admit of their having so great a breadth, and from this circumstance Bruninghausen has proposed notching them upon the two extremities of this diameter, so as to give them the form of the figure 8. In fine, we should be upon our guard against the causes of error when we examine these kinds of descents, because there are polypi which so exactly resemble the form of the neck of the uterus, that we may be deceived by them, and attempt their reduction. Such an error we once fell into.

Towards the close of the year 1823, a woman aged forty years presented herself at the hospital of la Faculté with, as she said, a falling down of the womb, for which she had worn a pessary during two years, but which having escaped, she had neglected for fifteen months. Directed by M. Bougon to examine this patient, we found a cylindrical or rather conoidal tumour projecting about two inches beyond the vulva, and capable of being readily returned: in its free extremity there was a transverse cleft which divided this portion into two unequal and tubercular lips, the anterior of which was a little longer than the posterior,

having its neck very slightly contracted a few lines only above the labia: but what completed the deception was, that this woman assured us that the catamenia flowed out at the cleft which we have just indicated. An ivory pessary with a stalk was introduced; the patient returned to the country and immediately resumed her ordinary occupations. Three days after, one of the cords which supported the pessary gave way and this instrument was removed: on the day following fever supervened; pain in the abdomen was felt, and this woman was reconducted to the hospital, where she died with a very acute peritonitis on the third day subsequent to her arrival. On opening the body, we ascertained that the supposed prolapsus uteri was merely a polypus attached to the bottom of the cavity of this organ. We have preserved this specimen, which is very remarkable from its resemblance to the neck of the womb.

Sect. 5. Of the Pelvic Region in the Female.

1st. The *Superior Strait of this cavity* (entrance of the excavation), deserves some attention here, on account of parturition; we will consider it, however, merely in relation to the disposition of the soft parts, as more lengthy details appertain to books which treat especially of the mechanism of labours.

From the examination which we have made of this opening in a great number of subjects, the following results have been obtained: It has the form of a triangle, the apex of which extends to the origin of the primitive iliac vessels, and presents the sacro-vertebral angle upon which the arteria sacra media rests. The skeleton or osseous portion of the base of this triangle comprises all that part of the pelvis which is included between the two *ilio-pubic eminences*, and consequently presents, in the middle, the summit of the bladder, upon the sides of which we see the two *pubio-vesical fossettes* bounded, externally, by the umbilical ligaments; a little more externally, the *crural* or *median fossettes* of the iliac groove, limited in their turn by the external iliac and epigastric vessels. The sides are formed by the *psoæ* muscles and the iliac vessels, and present posteriorly, near the angle, the ureters and the internal iliac vessels. It is in the anterior and lateral

angle that the vas deferens glides. In consequence of this disposition it follows that, in the recent state, the superior pelvic strait of the female is much broader anteriorly and obliquely from before backwards, than in any other direction. Thus, the anterior and transverse measurement, between the iliac vessels, just as they are about to pass upon the superior surface of the horizontal portion of the os pubis, is five inches; from the same point, that is to say, from the external part of the crural ring to the sacro-iliac notch of the opposite side, five inches likewise; whilst from before backwards, the distance is only four inches and a half; and transversely, in the middle, between the *psoæ* muscles, but three inches and three quarters. Two inches lower down, that is to say, below the *psoæ*, the cavity of the pelvis no longer presents the triangular figure of the superior strait; we then find five inches and a half across, and only four and a half from the pubic symphysis to the sacro-lumbar angle; but by prolonging a horizontal line backwards, an abstraction being made of the inclination of the pelvis, this diameter also presents five and a half inches; so that when the head of the child has once entered into the middle of the pelvis minor, it would turn as readily in one direction as another, if the twisting of the trunk did not oppose it.

2d. The *Rectum* is a little less inclined to the left side than in man; which is doubtless owing to the greater capacity of the pelvis. May not the greater frequency of perineal hernia on the right side than on the left in females be attributed to this disposition? The dilatation of this intestine is also, in general, more considerable on account of the habitual constipation to which many of them are subject. The recto-vesical *cul-de-sac* here becomes *recto-uterine* or *vaginal*, and descends much lower down; the utero-sacral ligaments, which form the contour of it, are no longer simple duplicatures of the peritoneum, but very evidently include, in a certain number of subjects, a fasciculus of fibres, which are fleshy, or of the same nature with those of the womb. This *cul-de-sac* being very deep, the viscera may be pressed into it during gestation, and become strangulated in two different manners: in the first place, by the uterus itself, because this cavity is prolonged behind the vagina to the extent of an inch, and an intestinal loop, finding less resistance at this point, might

easily be dilated in it, whilst the womb would compress it more or less strongly above; in the next, by the neck (collet) of the excavation, which may be more or less contracted, and especially because it is less dilatable than the fundus of the *cul-de-sac*. In both cases, we can conceive how the viscera engaged in this space may project into the vulvo-uterine canal and form a vaginal hernia, a hernia which was first observed by Garengeot, and afterwards very well described by Hoin, Richter, etc. We also conceive, in consequence of the union of the rectum with the vagina being more compact upon the median line than laterally, why this species of hernia more frequently takes place on one side than exactly upon the middle part. Again, if the intestine slides still more externally, it will form a hernia in the labia, as has been observed by Cooper, as related by Lawrence, and since noticed by M. J. Cloquet: this vulvar hernia, moreover, differs so little from that which is called perineal, that Scarpa seems to confound them. It appears to us, however, that the herniæ observed by Papen in a woman of fifty years;* by Bose, in a female subject of sixty;† by Mery‡ and Curade,§ in two women about the middle of their pregnancy; by Smellie,§ in two other pregnant women, etc., were decidedly perineal herniæ: whereas, those spoken of by Hartman,¶ Cooper, Scarpa, M. J. Cloquet, were positively situated in the labium, as well as another case detailed by M. Bomport in the *Revue Médicale* (1822). In short, by examining attentively all these facts, we will perceive that vaginal, vulvar and perineal herniæ, are merely varieties of the same disease, which may not only contain intestine, but also occasionally the bladder, as is proved by some of the preceding cases, and especially by those of Pipelet, Verdier, Hoin, etc. When the parts have protruded into the vagina, they occasionally rend the paries of this canal; in all cases, however, they are only covered by the mucous membrane, a cellulo-fibrous lamina, and the peritoneum, which forms the hernial sac; no large vessel is found in them; so that if strangulation should take place, we do not see what would prevent the division of the stricture. In order that they may penetrate into the labia pudendi, or project under

* *Disput. Chirurg. Halleri*, tome 2d. 1750. † *Programma de Enteroccele*, etc. Lips. 1772. ‡ Académie des Sciences, 1713. § Académie de Chirurgie, tome, 2. § *On Midwifery*, etc. ¶ *Acad. Nat. Cur. déc. 2. ann. 1686. obs. 17.*

the skin of the perinæum, it is necessary that the recto-vesical aponeurosis and the levator ani muscle should be stretched, torn, or very much enfeebled, and then they are enveloped by the skin; the subcutaneous layer, of greater or less thickness; the expanded fibres of the transversalis perinæi and constrictor vaginæ muscles; by another cellular or aponeurotic layer; by the levator ani, when it is not perforated; by the pelvic aponeurosis, if it is not lacerated; by the fascia propria, and, finally, by the peritoneum. In the latter case, the neck of the sac is at some distance from the surface, and the branches of the internal pudic artery are of such a size, that the operation might be attended with danger, if it should become necessary.

We may remark, further, that the more frequent occurrence of perineal hernia in females, leads to the belief that the greater capacity of their pelvis is one of the principal predisposing causes; so much so, that Scarpa is of opinion, that when these tumours are met with in men, the pelvis must possess some of the characters peculiar to that of the opposite sex.

3d. The *Uterus*, united to the broad ligaments, is so disposed that it divides the cavity of the pelvis into two portions, and that, as it is only supported by membranous folds, it is capable of moving in different directions, and of taking that position in which its weight draws it. Now, as its posterior paries is more convex than the anterior, it follows that it must preponderate most posteriorly, and that it will also tend to incline in this direction the more readily, because the recto-vaginal cul-de-sac prolongs the peritoneum much further upon this aspect than upon the anterior. Hence it is very natural to find retroversion of the uterus much more frequent than anteversion. We also conceive that, when this retroversion has once commenced, the intestinal convolutions, instead of sliding behind, will press upon the anterior surface of the uterus, thereby forcing it deeper in the pelvis, and that its fundus applied against the rectum will render the expulsion of the fæces more or less difficult; the bladder, likewise, is so attached to its anterior part, that it will repel it towards the sacrum or tend to raise its neck towards the pubes, according as it is in the state of plenitude or vacuity. The peritoneum descends upon the anterior aspect of the womb as far as its neck only; so that, as we have already stated, it is almost impossible, in performing vaginal

lithotomy, to wound the serous membrane of the abdomen. It also follows that this surface is not so long as the posterior, and that the cul-de-sac which separates it from the bladder, is not so deep as that which exists anterior to the rectum. This two-fold peculiarity, added to those which favour retroversion, must render anteversion, properly so called, very rare, we would even say impossible, if Levret had not related an example of the kind proved by autopsic examination; whereas the opposite displacement is very frequent during the unimpregnated state of the organ, and still more so during gestation. It may also be noted that, in the latter case, if the reduction is not accomplished previous to the fourth or fifth month, it will be rendered very difficult and even impossible, because the cavity of the pelvis being larger than its superior strait, it is to be apprehended that the uterus, already firmly compressed in the space which it occupies, cannot rise through the abdominal aperture, in order to resume its natural situation.

The lips of the neck, although embraced by the superior extremity of the vagina, nevertheless make such a considerable projection in this canal that, when enlarged, cancerous, or diseased in any manner whatsoever, they may be taken hold of and excised, as has been done by MM. Osiander and Dupuytren. It is necessary, however, in performing this operation, (which has just been practised with complete success by M. Lisfranc,) to recollect that the peritoneum or bladder are very closely approximated to them, and that an incision of some lines from the centre to the circumference would easily involve them. When the vagina, the broad ligaments, the bladder and the floor of the pelvis especially, are pretty supple or much relaxed, we conceive that the womb may be protruded by the action of the muscles, and afterwards acquire such an augmentation in volume as to render its reduction impossible. When a prolapsus or procidentia uteri occurs subsequent to parturition, or in a woman not pregnant, it has been supposed that the tumour might be removed, and successful cases of the kind are on record. The majority of surgeons, however, consider this operation too dangerous to approve of any attempt to perform it, and maintain that whenever it has been put in practice, either death has been the consequence, or the removal of a polypus has been mistaken for that of the womb.

It cannot be denied that several errors of this kind have been committed, and we will here relate a fact, which will serve to shew how readily such mistakes may be made, and how cautiously we should decide upon the cases related by authors.

In 1822, a woman, aged fifty-five years, was admitted into the Hospital *Saint Louis* who had carried, for several years, between her thighs a tumour of the size of the head of a child six or eight years of age. MM. Richerand and J. Cloquet, as well as all the pupils (*élèves*) agreed that this tumour was constituted by the uterus. A ligature was passed around its pedicle as high as possible, and the tumour cut off below the thread. The excised mass was carefully examined and presented the principal characters of the womb, the cavity of which even was supposed to be recognized; in fact, it was decided that the uterus had been extirpated; so that M. Richerand, who had always treated as *faibles* pretended cases of this nature, was convinced, if I may so say, against his will: he therefore had this specimen preserved carefully, for the purpose of shewing it to some learned societies, as soon as the women died or recovered. Every thing went on tolerably well for three days, but on the fourth she died. On examining the body after death, the cavity of the pelvis was found to be filled by a tumour covered with cancerous fungi; it was the uterus; and the mass which had been removed was nothing more than an enormous polypus. If this woman had recovered, would not all Europe have been convinced of the reality of this extirpation?

Be this as it may, the case of Rousset incontestably proves the possibility of success in such cases; and if, on the one hand, the women, operated upon by Vieussens and recently by Sauter, Siebold, and Wattermann, died, as well as the patient just operated upon by Dr. Wolf, in Hanover;* if an event so unfortunate has taken place in cases where ignorant accoucheurs have applied a ligature around the fundus of the uterus, inverted at the moment of delivery, as well as in that which came under our cognizance during the past year in a person who died at *la Charité*, and whose history is related by M. Boyer; on the other hand, it appears certain that this operation has been attended with complete success in Germany, in the hands of Langenbeck; and that M. Recamier has but recently performed it upon a lady who is en-

* The Lancet, vol. 9, Oct. 1825.

tirely cured ; so that this (the latter) fact, the most valuable and incontestable example which we possess, since this skilful professor has taken the precaution to preserve the specimen, in order to remove the least shadow of doubt, must terminate all discussion upon this subject.

The mobility of the womb not only permits such displacements as have just been mentioned, but also renders it possible for the entire organ, as well as the fallopian tubes and ovaries, to escape above the pubes. Chopart* has met with these parts in a sac which had passed through the inguinal canal, in the dead body of a woman of fifty years. M. Lallemant has related a similar case occurring in a female of the same age,† and a second in a woman of eighty-two years.‡ In these three cases the hysterocoele was formed without pregnancy being present ; which is somewhat extraordinary, because the uterus, in the state of vacuity, never rises so high as the superior border of the pubis, and nothing in the anatomical disposition of the organs could lead us, at the first glance, to presume upon the possibility of a similar hernia ; whilst, during gestation, we conceive that this organ might pass through a rent in the abdominal parietes, or the inguinal ring, or the crural canal, as occurred in the cases detailed by Sennertus, F. de Hilden, Sala, Ruysch and by a Surgeon of Copenhagen, who related the fact to Prof. Desormeaux. Finally, the envelopes of the tumour are the same in number, and similarly arranged as in enterocele ; and, if the operation should become necessary, it would doubtless exact the same precautions.

4th. The *Broad Ligaments* enclose in their superior border the ovary and its ligament, the fallopian tube and the sub-pubic cord or round ligament.

(a) The *Round Ligament* is nothing more than a fasciculus of the proper fibres of the womb, enveloped by the peritoneum, and which prolongs itself, making a semicircular turn with external convexity, towards the inguinal canal, in order to expand in the mons veneris, groin, and labium. Stronger and shorter on the right side than on the left, according to M. Chaussier and M^{me}. Boivin, it thereby becomes the cause of the more frequent incli

* Malad. Chirurg. tom. 2.

† Société méd. d'Emulat. troisième année.

‡ Bullet. de la Faculté, 1816.

nation of the womb in the first direction. If this fact is correct, and if we can account for it in the same manner that M. J. Cloquet explains the greater strength which he gives the cremaster muscle of the right over the left, it will follow that females who habitually make use of their left thoracic extremity, will have the round ligament of this side the strongest. Be this as it may, these cords are so disposed in the unimpregnated state of the uterus, that, if they possess a contractile action, they will tend to raise the uterus towards the pubis or one of the rings, instead of being capable of depressing the neck of this organ towards the penis, during the act of copulation, as Dionis imagined. During pregnancy, on the contrary, they evidently support it, and tend to draw it downwards and forwards. We have twice very manifestly observed the round ligament of the right side contract in such a manner as to form a very distinct tense cord, whilst the womb was acting in order to expel the placenta.

(*b*) The *Ovary*, moveable like the fallopian tube and uterus, is carried with the latter organ in all its displacements; besides, it may pass alone towards one of the natural openings of the abdominal parietes; and Verdier, Pott, and Lassus have met with it in the inguinal canal. The case related by Pott is peculiarly remarkable, inasmuch as it proves that the extirpation of this glandular body may sometimes be performed without danger, and that the female gradually loses the characters of her sex in consequence of this operation. This gland is formed of a tissue proper, and is enveloped by a species of fibrous shell enclosing germs, or ovulæ, and other hydatiforme vesicles. We can scarcely believe, at first sight, that a fibrous membrane so solid, so resistant, could rupture itself in order to permit the fecundated vesicle to pass into the fallopian tube; but we can easily conceive that, the central hydatids dilating, the ovary may transform itself into a large sac, simple or divided into separate apartments by septa more or less numerous, according as one or more vesicles are affected by the disease at the same time; in this manner we account for cysts and encysted dropsies of the ovary; cysts which may fill the whole of the abdomen, ascend as high as the diaphragm, and simulate completely an ascites, in driving back the intestines upon the sides of the spine, as we observed in the case of a woman, thirty-two years of age, who

died at the hospital of la Faculté, in 1824; cysts, finally, which may be made to disappear by means of the same treatment as is employed for hydrocele of the tunica vaginalis; that is to say, by attempting to produce adhesion of their parietes by means of irritating injections, without any apprehension of giving rise to the frightful train of symptoms which, it has been supposed, must be the consequence of similar injections thrown into the cavity of the peritoneum, because the pouch of the ovary then forms an isolated sac which has no essential relations with any other organ of the abdomen. For the same reason, also, if the tumour had not contracted adhesions by its external surface, we do not see that it would be so rash an experiment to attempt its extirpation. Besides, have not the English journals recently related several examples of a similar practice crowned with success? We also conceive that the cyst, by diving into the cavity of the pelvis may contract such relations with the vagina, that it would be possible to empty it by this canal, by practising the paracentesis, and that, if the opening was kept free, as it would occupy the most dependent point, a re-accumulation of the liquid would take place in it with difficulty.

(c) As it regards the *Fallopian Tube (Trumpet)*, it is necessary to remark, that the extreme narrowness of its canal satisfactorily explains how the fecundated ovula may be stopped in its course towards the uterus, and thus give rise to a tubal pregnancy; how, if it is completely obliterated, the product of conception may penetrate the fibres of the womb, and develop itself in the substance of the uterine parietes, as Wrisberg, Sandifort, and M. Breschet have observed.* The slight thickness of its parietes, on the other hand, renders a rupture of the pouch very easy, a rupture which would convert a tubular into an abdominal pregnancy, as well as produce an extravasation into the peritoneum. Its free extremity being expanded in the form of a tunnel, and being attached, on the other part, to the ovary by one of its fimbriæ, we can comprehend how it may happen that an ovula, stopped in its escape from the ovary, becomes developed, forming a pouch, in this situation, so that it would be diffi-

* The very singular preparation delineated by M. Baudelocque, in the *Archives Générales de Médecine* (Novembre 1825), does not seem to us of a nature to contradict the explanation which we give of these facts.

cult at first sight to say whether the pregnancy is ovarian, tubal or peritoneal. Finally, from its relations we will perceive, that, if we should perform the operation of gastrotomy for the purpose of extracting a foetus enclosed in its cavity, we must generally seek for it towards one of the iliac fossæ.

5th. The *Bladder* generally rises a little higher above the pubis than in man, so that the hypogastric lithotomy is more easy and less dangerous in the female; a fortunate circumstance, for it is in this sex particularly that we are obliged to have recourse to it. Pressed by the uterus from behind forwards and from below upwards, during gestation, its neck rises more or less behind the symphysis pubis, so that it becomes almost vertical; sometimes also it is so much flattened at this time, that the excretion of urine is prevented, and the urinary reservoir may acquire in this case very great dimensions; so that, during labour, it might neutralize the muscular contractions, or be burst under their influence, if we did not take the precaution to evacuate it at the commencement of the pains. Pushed against the anterior articulation of the pelvis by the neck of the uterus, in the commencing retroversion, its distension, which is then an effect of this retroversion, favours it in its turn, and soon becomes a secondary cause of it, not the primary, as was the opinion of Denman, by forcibly repelling the fundus of the womb backwards. Thus compressed between the pubes and abdominal parietes, on the one hand, and the uterus on the other, the bladder becomes much broader than in man, and frequently seems to be divided into two portions by a gutter of greater or less depth, which is moulded upon the fore part of the uterus: this disposition is observed especially in women who have had many children. Its relations with the womb and vagina, almost as far as its *bas-fond*, are such, that its relaxed walls permit it, when it is filled with urine, to form a hernia in the vagina; and the tumours, spoken of by Sandifort, Robinet, Verdier, Chaussier, Hoin, etc., were complete vaginal cystoceles. We likewise conceive that it may also glide upon the sides of the vagina, and descend into the labium or perinæum, as the facts related by Pipelet, Méry, Curade, Hartmann, etc., prove, and that the only means of keeping it reduced, consists in the introduction of a vaginal pessary in the form of a plug. Finally, in women who are pregnant, and sometimes in those

who are not, it approximates so near to the inguinal and crural apertures, that it is exposed to protrude through them, if driven by any effort in this direction: thus Delaport has seen a double inguinal cystocele in a female of seventy; Pott, in a girl of six, and in another of thirteen years. Levret and Verdier have found the bladder in the fold of the groin, having protruded through the crural canal. Levret also relates the case of a woman in whom the urinary reservoir formed simultaneously a hernia in the vagina and by the crural arch.

In the female pelvis we likewise find, the peritoneum, fascia propria, aponeurosis, muscles, vessels, nerves and arteries, the same as in the male; and, in addition, the vaginal and uterine arteries and veins, and the ovarian vessels which supply the place of the spermatic. There are no vasa deferentia. Almost all of these vessels, being at first enveloped in the broad ligaments, they must necessarily be divided when the uterus is totally extirpated; and M. Recamier is diligently seeking out the means of applying a ligature around them previous to excising it.

With respect to the situation of the uterus during gestation, we may observe that it does not rise so high as the upper part of the pubis until about the third month; in the course of the fourth month, it is nearly two inches above it: at the termination of the fifth, its fundus is near the umbilicus, which it generally rises above in the course of the sixth, and does not reach the epigastric region until the end of the seventh, so as to fill it almost entirely in the eighth; finally, in the ninth, it rather descends than ascends. We may also note, that, during its ascension, the uterus inclines more or less to the right side, turning upon its great axis, whereby its anterior surface is directed at the same time to the right, and its posterior to the left; so that the cesarean operation, performed upon the median line, would fall near the border which has become anterior, and consequently upon a point abundantly supplied with very large vessels; which should make us prefer the transverse and lateral methods, and the right side.

Sect. 6. Sacro-Coccygeal Region.

This region is a continuation of that of the loins and termin-

ates the posterior part of the trunk : like the bones from which its name is derived it is triangular, and is bounded, superiorly, by the posterior sixth of the hypogastric line ; laterally, by the eminence which the iliac crests form behind ; inferiorly, it terminates at the apex of the coccyx. Above, it is concave transversely ; below, concave. In the excavation and upon the median line, we feel the spinous process of the sacrum and the posterior surface of its appendix ; its lateral portions terminate inferiorly by a double notch which leads into the anal region, and which are limited, in the middle, by the coccyx ; at the sides, by the projection of the glutæi muscles. It is in the bottom of the superior excavation that we apply one extremity of the pelvimeter, whilst the other is placed upon the fore part of the pubes, in order to ascertain the dimensions of the sacro-pubic diameter, which we may suspect to be very narrow when this concavity is very deep ; as we observe, especially in those females who have contracted the habit of throwing the head and pelvis backwards, in order to render the chest prominent. Then, the total curvature of the region is more or less augmented, and its convexity more developed. Therefore, as this disposition necessarily coincides with a deeper concavity of the posterior wall of the cavity of the pelvis, and, consequently, with more or less diminution of the sacro and coccy-pubic diameters, it is necessary to examine it attentively in females, when we wish to ascertain whether their pelvis is well or ill formed.

CONSTITUENT PARTS.

I. *The Skin.*

Its characters are for the most part similar to those of the skin of the loins ; but it becomes much thinner as it descends ; so that, upon the posterior part of the coccyx it has lost a great proportion of its thickness, though it still preserves the same density and compactness of structure.

II. *The Subcutaneous Layer.*

Upon the median line, it becomes more compact in proportion

as it descends ; and, quite inferiorly, it is so firmly united to the periosteum or fibrous textures and the integuments, that the skin appears to be adherent to the bones. Laterally, we observe adipose vesicles, but fat is never deposited in them in any considerable quantity. From this arrangement it results that, in the decubitus dorsalis, the skin of the sacrum supporting a portion of the weight of the body, this membrane ulcerates and sloughs with great facility, when it becomes necessary to preserve this position for a length of time, as, for example, in fevers of a bad type, paralysis, etc. It also follows from it that subcutaneous tumours of the region under consideration, but very seldom acquire a great magnitude, that infiltrations do not readily take place and that abscesses are rare in it ; but when the integuments are once ulcerated, they become detached with the greatest facility.

III. *The Aponeurosis.*

This is but a portion of the origin of the aponeurosis of the latissimus dorsi muscle ; it transforms into a canal the sacral gutters, it is blended with the super-spinal ligament prolonged upon the spinous processes of the sacrum, and, besides, inferiorly, with the subcutaneous layer as well as with the periosteum. In the inferior half of the region, it seems to expand towards the sides, in order to give rise to the thin sheet which covers the glutæi muscles, and which we will again see in the region which follows.

IV. *The Muscles.*

We have here the point of origin of the sacro-spinal muscle, included in the canal formed by the aponeurosis behind, and the posterior surface of the sacrum, before. This fleshy portion presents nothing worthy of surgical consideration ; a small quantity of adipo-cellular tissue separates it from the fibrous paries of its canal, as in the lumbar region ; below, or rather upon the sides of the coccyx, we find a very small portion of the glutæus maximus.

v. *The Arteries.*

These vessels are derived from the posterior branches of the gluteal, ischiatic, internal pudic and middle and lateral sacral arteries; the latter pass through the posterior sacral foramina in order to get into this region: they merit no attention in operations.

vi. *The Veins, Lymphatics and Nerves.*

All these organs, distributed like the arteries, are still less important.

vii. *The Skeleton.*

It is known that it encloses the sacral canal, that this canal contains the last spinal nervous branches, that it is lined by a prolongation of the encephalic meninges, that it is formed by the conjunction of the plates which each of the false vertebræ of which the sacrum is composed in the fetal state presents, and that, if this conjunction should be prevented in any way whatever, it will be transformed into a deep gutter; so that, sometimes, a pouch is formed at the expense of the spinal membranes and integuments, which projects externally, and is called *Spina Bifida*. From this, we conceive that a similar disease must always be congenital, and that as its primitive cause exists in the state of the medulla and its membranes, it cannot fail to be extremely dangerous, and speedily produce death, if opened so as to admit of the entrance of air into this species of pathological sac. As the sacral canal is never completely closed below, except by means of the sacro-coccygeal ligament, we would have some reason to expect the more frequent occurrence of spina bifida at this point, if the osseous channel did not become narrower and narrower, if the surrounding soft tissues did not increase more and more in compactness, and if the natural curvature of the bone did not become greater as it approximated the coccyx. Nevertheless, we once met with such a case: the child, otherwise well formed, was eight days old; its health appeared to be good; this tumour was of the size of the fist, soft and fluctuat-

ing: it was connected to the posterior surface of the coccyx by means of a large thick pedicle; the skin which covered it was reddish and of considerable thickness; by pressure it was made to disappear almost entirely, and the child immediately had convulsions. With the result of this case we have not been made acquainted.

In general, we may say that *spina bifida* projects externally only on account of the incomplete ossification of the spinal canal, whether this tumour manifests itself in the sacral portion, or at any other point of the vertebral column; but this defect of ossification is an effect of the disease, the true cause of which must be sought for in the cerebro-spinal system or its membranes. Further, as the skin, being more compact upon the median line, sometimes divides this tumour into two portions, we may ask whether its name proceeds from the spinal column being bifid at this point, or from the form which the hydro-rachitic sac presents.

In the adult, the sacral canal does not enclose the medulla spinalis, since it terminates on a level with the second lumbar vertebra; the nervous branches which go to the pelvic plexus are the only ones which are met with in it; and, as this plexus also receives the great sacro-lumbar nerve, we conceive that the transverse division, or the destruction, in any manner whatsoever, of all the branches contained in the sacrum, would not necessarily be followed by complete paraplegia. These nerves, are besides, perfectly protected by the spines and laminae of the sacrum, which are longer, stronger, and more solid in proportion to the height at which we examine them, and by the muscular masses, aponeurosis, as well as the posterior prominences of the ilium, which are equally more considerable above than below. In the latter direction, in fact, all these parts disappear; there is no longer, so to say, any canal; but therefore, nature has not placed in this situation any important organs requiring protection.

As to the body of the sacrum, it is sometimes found bifid, or perforated, so that the rectum has formed a hernia posteriorly;* and this tumour might be mistaken for a *spina bifida*. This is a disposition which would seem to give support to an opinion promulgated by F. Meckel, in 1816, viz. that the body of each verte-

* Journal of Foreign Medicine, No. 16.

bra is originally formed from two points of ossification ; an idea, since revived by Tiedemann, who applies it to all the organs, and also by M. Serres, who draws from it similar consequences, and who considers it as a fundamental principle of organization, to which he has given the name of the *law of symmetry*, if B  clard had not shewn that the apophyses are formed previous to the central point of ossification, and, consequently, that the anterior spina bifida does not prove that the portion of the spine, relative to *station*, is primitively constructed of two osseous nucl  i for each of its pieces, that is to say, for the body of each vertebra. Besides, the small number of examples which we possess of the os sacrum bifid anteriorly, and of vertebr  e in the like condition, have not been related with sufficient minuteness to enable us to draw positive conclusions from them, and we only notice them on account of the new species of hernia which may be the result, a hernia which has been observed, and which we may call *sacro-rectal*.

At birth, and for several subsequent years, the sacrum is very narrow in comparison to what it will be afterwards, and the small transverse extent of the pelvis in children is especially owing to this circumstance. In the adult female, its base being four inches and a half in breadth, it is not possible that the transverse diameter of the superior strait can be diminished to such a degree as to prevent the delivery of the infant. As its thickness is two inches and a half, and that of the symphysis of the pubis six lines, it follows that the sacro-pubic diameter, measured from the exterior, must give seven inches and a half ; and as this thickness, taken by Baudelocque upon a great number of sacra, is never found to vary over a few lines, we may calculate upon these dimensions. It is necessary to state, however, that M  me. Lachapelle points out greater variations. This bone forms with the coccyx, from above downwards, a curvature of about six and a half inches, and as the height of the symphysis pubis is only nineteen lines, we conceive that the head of the child must be protruded with much more difficulty when the occiput, which should always come out first, follows the posterior wall of the pelvic cavity, than in the opposite case ; when the depth of this curvature is increased in females, if the two extremities of the sacrum approximate, by inclining more towards each other anteriorly, it will follow that

both straits of the pelvis will be simultaneously contracted, and then, the head of the child, having passed the superior, will run a great risk of being locked in the cavity of the pelvis above the inferior strait; if it is the base of this bone only which projects forwards, the lower opening of the pelvis will be larger than usual; the superior, on the contrary, being narrower, might lead to serious errors in the prognosis; for the accoucheur, called in when the labour has already been of long continuance, and finding the head still but little advanced in the abdominal strait, will decide, unless he ascertains the state of things, that the woman is far from being delivered, whilst as soon as it has traversed this opening, the labour will be accomplished with very great rapidity. If, instead of this, it is the apex of the sacrum which is principally carried towards the pubis, the perineal strait being narrow whilst the other is very ample, we may be deceived in an inverse manner; that is to say, judging from the short time that has elapsed since the commencement of the pains, and from the few contractions which have been necessary to propel the head to just above the vulva, we may suppose that the labour will soon terminate, when, on the contrary, it is perhaps utterly impossible for it to be accomplished without assistance. Finally, the coccyx alone may equally present obstacles to parturition if it is too much elevated towards the arch of the pubis, or is ankylosed with the sacrum, as occurs in women who are thirty-five, forty, or more years of age before they become mothers; otherwise, its mobility permits it to be repelled by the pressure which operates upon its pelvic surface. In man, this ankylosis takes place much sooner; hence, falls upon the seat sometimes occasion its fracture, as we occasionally observe in those who skate or run upon the ice. It may here be observed, that, although these fractures, in either sex, may at first sight appear of but little consequence, they are nevertheless sometimes attended with pretty severe symptoms, such as pain in sitting down or during defecation; the inflammation consequent upon it may even attack the surrounding parts, and produce vast abscesses in perinæo, necrosis of the bone, etc.; and that, because the rectum and the muscles which are attached to the coccyx being obliged to act in order to fulfil their functions, thereby render the consolidation very difficult. As for the rest, it is this bone which serves as a fixed

point to the sphincter ani muscle ; and as, on the other hand, this muscle is continuous, in a more or less complete manner, with the accelerator urinæ, which, in its turn, derives from it its fixed point, it follows that the urine and fæces are with difficulty expelled at the same time.

Let us also remark that the anterior sacral foramina are prolonged outwards by as many grooves, which converge towards the great sciatic notch, and which are disposed in such a manner as to defend, in part, the sacral nerves from the pressure of the foetal head, during its passage through the cavity of the pelvis. Finally, although this bone is thick and spongy, although wedged between the others and deeply seated, it is nevertheless susceptible of fracture, and even of indirect fracture, oblique or parallel to its length; a case of which M. Larrey has recently exhibited to the *Académie Royale de Médecine* and to the *Société philomatique*.

As the order of superposition of the parts in the sacro-coccygeal region present nothing interesting in a surgical point of view, we do not think it necessary to describe it ; it is sufficient to know that a pointed instrument, a sword, for example, thrust obliquely outwards or upon the sides, in its superior half, would easily penetrate into the sacro-iliac articulation.

Sect. 7. Glutæal Region, or the Haunch.

This region comprises all those parts which rest upon the lateral portion of the pelvis. It is bounded, posteriorly, by the sacro-coccygeal region; anteriorly, by a line which would fall from the anterior and superior spinous process of the ilium upon the trochanter major; superiorly, by the contour of the iliac crest, and inferiorly by another line drawn from the great trochanter to the ischion, and from thence towards the apex of the coccyx. The surface of this region, therefore, presents a considerable number of osseous eminences, which may be felt under the skin: in short, it is rounded and very protuberant.

CONSTITUENT PARTS.

I. *The Skin.*

Thicker superiorly and posteriorly than inferiorly, it is everywhere extensible, soft and supple: whence it follows that tumours which are developed beneath it, may attain to a very great magnitude in the hip, without the integuments necessarily becoming disorganized; it is covered by a small number of hairs only, and does not present wrinkles except in those who have lost a considerable portion of their embonpoint; but it encloses very large and very deep-seated sebaceous follicles: therefore boils and carbuncles of a very painful nature are very frequently developed in it.

II. *The Subcutaneous Layer.*

This is very apparent, or scarcely distinct, according to the emaciation or obesity of the subject; it is always formed of lamellæ and filaments intermixed with some nervous and vascular twigs. As it is this layer which contains the adipose cells, its thickness necessarily varies, and, in its turn, produces a variation in the prominence formed by the buttocks, constituting an enormous mass in the women of some parts of Africa, the tribe of Boschimans, for example, but rarely exceeding an inch or two in Europeans. From its softness and the abundance of the element which composes it, phlegmonous inflammations and purulent collections frequently and rapidly form under the skin of the hips, and as it is, by ultimate analysis, only a portion of the general fascia superficialis, as it is continuous especially with the ischio-rectal cellular mass, as well as with that of the thigh in general and of the perineum, it follows that pus or other extravasated fluids should be promptly evacuated, if we wish to prevent the matters from extending more or less towards these points, and producing very great disorders: further, it is blended with the aponeurotic laminae on the tuber ischii, in order to form a bursa mucosa, which does not always exist; the same takes place upon the external surface of the great trochanter, where it forms one

of those synovial sacs which we generally find wherever muscles are obliged to move over bones; sacs which are occasionally distended with the fluid which naturally moistens them, and thus give rise to tumours called *ganglions*. Finally, as it is not of a compact texture, it permits the skin, in cases of recent wounds, to be drawn from a distance, so as to admit of union by the first intention, notwithstanding they may be attended with great loss of substance: therefore, in the removal of tumours from this region, it is not necessary to preserve much of the integuments.

III. *The Aponeurosis.*

It does not exist, properly speaking, but on the fore part of the glutæus maximus muscle; taken at this point, it soon splits anteriorly, in order to form a sheath for the extensor fasciæ latæ muscle, upon the anterior margin of which its two sheets again approximate, in order to become continuous with the aponeurosis of the thigh; posteriorly, it splits likewise, so that one of its laminae applies itself upon the external surface of the glutæus maximus, whilst the other glides upon its internal or anterior aspect. Both are then very thin, and simply cellular; they re-unite behind this muscle, and become attached to the outer surface and margin of the great sacro-sciatic ligament; so that they seem to be continuous, in a pretty evident manner, with the aponeurosis of the perinæum. Attached superiorly to the spine of the ilium, it loses itself inferiorly in the femoral aponeurosis. From this arrangement it follows, that the glutæus maximus muscle is supported by two cellular layers only, whilst the greater part of the glutæus medius is enveloped in a species of sac, which is half fibrous, half osseous, and that abscesses which are developed between the integuments and the first muscle, being limited by nothing solid interiorly, readily infiltrate and penetrate between its fibres; whilst upon the second, on the contrary, these same collections will always be obliged to take their course towards the skin.

IV. *The Muscles.*

(*a*) The three *Glutæi* are the principal ; they give to the hip its characteristic shape, and constitute the fleshy mass which fills the external iliac fossa.

The *maximus*, or most superficial, originating from the posterior part of the spine of the ilium, the posterior surface of the sacrum and the coccyx, and being inserted into the posterior border of the femur below the great trochanter, must act in such a manner that, deriving its fixed point from the os femoris, during *station*, it draws the posterior part of the pelvis downwards, so as to maintain the equilibrium, thus becoming an extensor of the trunk ; if it acts on the femur, on the contrary, it tends to carry the thigh backwards in extension, and to turn the knee and point of the foot outwards. It covers and conceals the sacro-schiatic notches and ligaments, the pyriformis, gemini, quadratus femoris and glutæus medius muscles, the nervous branches of the sciatic plexus, and numerous vessels.

The *Glutæus medius* more especially fills the external iliac fossa, and as it is directed obliquely outwards and backwards, in descending upon the superior and anterior part of the great trochanter, it tends particularly to carry the limb in adduction, or to incline the pelvis towards its side ; so that, in fractures of the os ilii and cervix femoris, it may become a cause of displacement, and that, in luxations of the hip joint, it concurs in drawing up the head of the femur towards the spine of the ilium.

The *Glutæus minimus* originates lower down in the external iliac fossa, supports more solidly the articulation of the hip, upon which it is immediately applied ; but, as it is inserted into the superior border of the great trochanter, its action is congenial with the preceding. In external and superior luxations, it is this which immediately covers the head of the os femoris ; when there is a fracture of the neck of this bone, it is one of the principal agents which shorten the limb, because it draws directly upon the trochanter major, and because its arrangement, similar to that of the temporal muscle, gives to it great power, by means of its central tendon, which multiplies its points of insertion and the number of its fibres.

These three muscles are separated from each other by a supple lamellar cellular tissue, small in quantity and sometimes adipose; a tissue, which is continuous, through the great sciatic notch, with that of the pelvis, and, by passing behind the articulation, with that of the posterior part of the thigh; so that sub-peritoneal inflammations may naturally be transmitted to the hip, by continuity, and morbid fluids accumulated in the deep cellular layer of the abdomen, will easily extend between the muscles of the haunch, and there form purulent depositions (*abcès par congestion*), from whence they may pass without difficulty below the the ischion, and even before the neck of the femur, in order to reach the groin. It is, moreover, somewhat unusual to see these intermuscular layers become the seat of idiopathic phlegmonous inflammation.

The *Pyramidalis*, *obturator internus* and *externus*, and the two *gemelli muscles*, being fixed upon the pelvis, on the one hand, all pass to terminate in the digital cavity of the great trochanter, on the other; so that the first coming out of the great ischiatic notch; that the second and the third embracing the neck of the ischium, the one below the ischiatic spine, the other below the cotyloid cavity, direct their course transversely towards the trochanter major, and are rotators of the point of the foot outwards; that the two last, attached above and below the lesser ischiatic notch, receive between them, upon their posterior surface, the obturator internus, with which they are confounded; so that their mode of action upon the femur is the same. Finally the *quadratus femoris*, which passes from the tuberosity of the ischium to the posterior border of the trochantral eminence, is also a rotator outwards, and terminates the series of the small muscles which are applied upon the posterior surface of the coxo-femoral articulation.

(c) The *Tensor fasciæ latæ* muscle forms, inclusively, the anterior limit of the region, and consequently extends from the anterior and superior spinous process of the ilium to a little below the trochanter major; included in its fibrous sheath, it acts entirely upon the femoral aponeurosis, so that, if it was cut across, this membrane would afterwards be but imperfectly stretched.

We see, from this arrangement of the muscles of the hip, that

it is possible to include them all in one flap, by passing a knife from the anterior border of the fascia lata upon the posterior surface of the cervix femoris, in order to make its point come out below the ischium, as MM. Sanson and Begin have advised in amputating at the joint. We may observe that the coccy-femoral border of the glutæus maximus, in making the posterior notch of the inferior strait to disappear, gives to the anal region a form nearly triangular, and that it is above it that the ischio-rectal excavation of the perinæum is prolonged. We may also note that the tuber ischii, concealed by this muscle during the erect posture, is uncovered in the sitting posture, and that it is, in the latter case, only separated from the skin by a species of fibro-cellular and adipose cushion, of greater or less thickness: therefore, it is necessary, in measuring the ischiatic diameter of the pelvis, for the woman to be seated.

v. *The Arteries.*

(a) The *Glutæal artery* is the largest, and appertains almost exclusively to this region. It comes out of the pelvis at the upper and posterior part of the great sciatic notch, between the pyriformis and glutæus minimus muscles, and immediately divides into a considerable number of branches, which are spread out under the deep surface of the glutæus maximus, behind the medius; so that, should it become necessary to take up the trunk, we would be obliged to seek for it, so to say, even in the ischiatic notch. As to its branches, one of the principal passes between the glutæus medius and minimus, and following the curved line from which the latter originates, directs its course towards the anterior spinous process of the ilium; a second ascends in the fibres of the former, and also takes a curved direction, similar to that of the iliac spine; finally, a third, which is usually the thickest, turns backwards upon the origin of the sacro-sciatic ligaments, and is distributed to the glutæus maximus muscle. Its branches furnish others of less importance or of smaller size, which ramify in the fleshy bundles and anastomose, superiorly, with the circumflex iliac, the lumbar and ilio-lumbalis arteries; anteriorly, with the external circumflex of the femoral; inferiorly and posteriorly, with the ischiatic and some branches of the internal

pudic, etc. The depth at which the trunk of this artery is situated will always oppose the attempt to expose it, in order to tie it, in case of aneurism of one of its branches: therefore Drs. Stevens and Atkinson, in two cases of this nature, have preferred applying the ligature around the internal iliac itself. But if, as in the case related by Theden, it should be wounded in seeking to extract a foreign body, a ball, for example, it would be better to lay it bare and compress it, or tie it, as was done by John Bell, in a case in which one of its largest branches was divided. It will be difficult then to lay down fixed rules for the performance of this operation, for the surgeon must depend entirely upon his own knowledge. But at all times, it is necessary to have a correct knowledge of the relations and position of the artery, before its division.

(b) The *Ischiatic*, originating from the internal iliac, also comes out from the ischiatic notch, but between the pyriformis and superior gemellus, and much nearer the ligamentum sacro-ischiaticum posterius; there, it is at first upon the internal side of the pudic, the posterior surface of which it soon crosses, in order to place itself on its outer side; as it descends towards the ischio-trochantral notch, it crosses the gemini, obturator and quadratus femoris muscles. It is covered by the glutæus maximus, and only gives off three branches which deserve attention in this region; one, which follows the external surface of the gemini and obturator internus muscles, in order to go to anastomose with the glutæal and anterior circumflex arteries upon the great trochanter; the other, which turns over the tuber ischii and ramifies in the perinæum and external sexual organs; the third, which is the continuation of the trunk, descends to the thigh between the glutæus maximus, biceps and adductor magnus muscles. If either of these branches was so large that its division should give rise to a dangerous hæmorrhage, it would not be very difficult to compress the trunk at its passage behind the ligamentum sacro-ischiaticum minus, in the same manner as was advised in relation to the internal pudic artery in the perinæum, although, in fat persons, we must not place too great dependence on this method.

(c) The *Internal pudic*, in coming out from the pelvis, applies itself immediately upon the small sacro-sciatic ligament, near its attachment to the spine of the ischium; so that it is there seen in

the apex of the triangle which is formed by the external margin of the great sacro-sciatic ligament and the pyramidalis muscle, covered by the glutæus maximus only ; and in such a manner that it is possible, during the relaxed state of this muscle, to obliterate, for a moment, the pudic artery at this point. It is also in this place that we may pretty readily expose and tie it, if we cannot seize the principal branch in the perinæum, when divided in the operation of lithotomy, or in any other manner. It afterwards enters into the pelvis by the small ischiatic notch, and rests upon the fore-part of the productio falciformis of the great ligament which converts this notch into a foramen. Then, it appertains to the perinæum, where we have already seen it. No remarkable branch is given off by it during its passage across the glutæal region, and the anastomoses which it there contracts are generally of but slight importance.

VI. *The Veins.*

They are much larger and more numerous than the arteries, and every where follow the same direction ; each of the principal branches of the latter have, in general, two venæ comites, with which they are in immediate contact and pretty intimate union ; all of them possess valves ; from which circumstance, when an injection is thrown into the trunks contained in the pelvis, it with difficulty penetrates into these vessels : finally, they have no relation with surgical operations.

VII. *The Lymphatics.*

In this region, as in almost all other points of the body, this system consists of two orders ; one, subcutaneous, or superficial, passes to the glands of the groin ; the other accompanies the bloodvessels into the pelvis ; whence it follows, as a natural consequence, that diseases of the integuments and of the subcutaneous tissue will produce tumefaction of the inguinal glands ; whilst abscesses, inflammations, and other deep-seated affections, will re-act upon the organs contained in the cavity of the pelvis. We sometimes find one or several lymphatic glands around the principal arterial vessels, but they are not regular either in number, volume or position.

VIII *The Nerves.*

The *gluteal* (glutæus superior), *small ischiatic* (glutæus inferior) and *internal pudic* nerves have the same distribution as the arteries, and only deserve notice in surgery because it is proper to avoid them when we tie the vessels, after amputating at the hip joint.

The *Great sciatic nerve* then, is the only one which should engage the attention of the surgeon in this region ; it comes out of the pelvis, between the pyriformis and superior gemellus muscles, with the pudic artery, on the outer side of which it is placed, and and from which it separates in descending, because it remains without the tuber ischii, whilst the artery passes on the inner side of this prominence ; it is covered by the glutæus maximus muscle as far as below the ischio-trochantral groove, where it arrives after having crossed the gemini, obturator and quadratus femoris muscles : it is considered to be the seat of disease in *sciatic neuralgia*. It is true that its volume and distribution very readily explain the violent pains which frequently characterise this disease ; but, are not very different diseases confounded under the same name ? Have not, for example, chronic and deep-seated inflammations, diseases of the periosteum, of the bones and of the sacro-iliac articulation, been frequently treated as simple sciatic neuralgia ? We possess several facts which give support to these suspicions. Be this as it may, the relations of this nerve are such, that every compression established between the trochanter major and the coccyx or ischion, may suspend its action for the moment : hence, when we have been sitting for some time upon a hard body, we feel a chill, formication and more or less numbness throughout the whole length of the corresponding abdominal extremity, so that one of the thighs only can support the weight of the body.

IX. *The Skeleton.*

This is composed of the iliac bone, of the tuberosity of the ischium, and the sacro-sciatic ligaments.

The first of these bones being inclined downwards, it thence

follows that its spine advantageously repels vulnerant bodies, and causes them to glide upon its external surface ; however, as it is very thin at its middle part, it may be perforated by a ball, a sword, or any other pointed instrument, so as to permit the entrance of these bodies into the pelvis ; being broad and thin, its fractures are easy and pretty frequent, notwithstanding it is well covered by thick muscular bundles. The ischium itself, notwithstanding its strength and thickness, is susceptible of solutions of continuity ; which must be very rare, however, because its position shelters it from the action of external violence. As it is upon the two bones of this name that the weight of the body bears, when in the sitting posture, and as they naturally incline towards each other as they descend, it follows that in mollities ossium (*ostéo-malaxie*,) in rachitic children in particular, this position will favour the narrowing of the transverse diameter of the perineal strait. We also conceive that the two ischia will be pressed towards each other, or that one of them only will be turned inwards, according as the pressure is equal or unequal, or the softening of one of them greater than that of the other.

The ischium is united to the sacrum and coccyx by means of the sacro-ischiatic ligaments, and in such a manner, that one of these fibrous bandelets passing transversely from the sacral border towards the ischiatic spine, divides into two parts the very large aperture into which the two sciatic notches have been converted by the other band, which extends from the same border, and from the posterior and superior iliac spine upon the internal labium of the tuber ischii. Of these two openings, the superior, which is the largest, is oval, and gives passage in the middle to the pyriformis muscle ; to the glutæal vessels and nerves superiorly, and inferiorly to the great and small sciatic nerves, the vessels of the same name, the internal pudic artery, veins and nerve ; so that all of these parts, at their exit from the pelvis, are covered by a fibrous membrane, which is only an expansion of the external and superior border of the great sacro-ischiatic ligament, an expansion which is soon lost in the cellular tissue, as it passes towards the great trochanter, and which must strengthen, in a very special manner, the posterior part of the great sciatic notch, naturally weaker in this situation. It is, nevertheless, by this aperture that the viscera must escape in ischiocele, because the arcade of the

pelvic aponeurosis, which is completely filled posteriorly and inferiorly by the sacral plexus and the pyriformis muscle, leaves no other free space. There is no one who cannot now comprehend what must be the relations of the displaced parts in ischiatic hernia, and also the course which they are obliged to take, in order to arrive at the margin of the anus. Thus, after having passed through the notch, above or below the pyriformis muscle, they will be enveloped by the peritoneum, the fascia propria, and the fibrous expansion of which we have just spoken; the great sciatic nerve, the glutæus maximus muscle and the glutæal vessels, will be pushed backwards or inwards; the internal pudic vessels and nerve will remain on the outer side, and the hernia will glide between the glutæus maximus muscle and the posterior surface of the great sciatic ligament, so as to descend into the ischio-rectal excavation, between the coccyx and the ischium. To the preceding envelopes we must then add a layer which is detached from the posterior sciatic ligament, in order to be spread over the superficial face of the great glutæus; another lamina, formed by the subcutaneous layer, and lastly the integuments. Further, we may also comprehend how that this tumour, instead of protruding in the perinæum, may quite as, and even more easily, make its way directly by the ischio-trochantral notch, in order to reach the posterior aspect of the thigh; but, as Doctor Jones is the only person who has had occasion to examine this disease upon the dead body, and as Sir A. Cooper, who relates this case,* does not enter into details sufficiently minute respecting the relative disposition of the parts, we must wait for other observations of this kind, before we can speak more fully on the subject.

The other, or inferior opening, is much smaller, triangular, and filled with the obturator internus muscle, as well as by the internal pudic vessels and nerve, which pass towards the inner surface of the tuber ischii, etc. It should be observed that the spine of the ischium, into which one of the ligaments is inserted, is sometimes inclined inwards, so as to form a projection within the pelvis minor, whereby it contracts, more or less, one of its diameters; but, it would be ridiculous to admit, with Levret and A. Petit, that this process can dive into or hook upon the hairy scalp of the child,

* On crural hernia, &c. page 73.

during parturition. In fact, the soft parts, the parietes of the womb especially, are more than sufficient to prevent it.

As the sacro-sciatic ligaments form a great portion of the perineal circle of the pelvis, it is evident that the oblique diameters of this strait are susceptible of a certain elongation, and we are somewhat surprised that the opinion of M. Murat, on this point, is not more general.

The broad portion of the coxal bone is so articulated with the sacrum that, in the natural state, every species of motion is impossible, because the mass of yellow fibrous tissue which constitutes the posterior sacro-iliac ligament, is intimately united to the osseous surfaces. But, in females, during pregnancy, all the fibrous parts which surround this articulation, imbibe so much liquid, that the mobility of the symphyses become so manifest among some of them, at the approach of child birth, as to render progression difficult, even dangerous. This fact, admitted by *Ætius*, considered necessary by *Fernel*, denied by *A. Paré*, until *S. Pineau* proved to him its existence upon a woman executed eight days after labour, defended with some éclat in the thesis of *Bertin*, under the presidency of *Bouvard*, is not so constant a phenomenon, as some moderns pretend, but one which is very commonly met with, and which does not constitute a disease, in all cases, as *Baudelocque* supposed. *MM. Chaussier* and *Béclard* have seen this separation in a great many subjects, and sometimes carried to such an extent as to admit of the introduction of the thumb between the two ossa pubis. Moreover, there are animals, the mole, for instance, in which the pelvis is so narrow, that it is, if I may so say, obliged to decompose itself, in order that parturition may be effected: thus, in them, the different osseous pieces isolate, and remove from one another in such a manner that, during gestation, they admit of very extensive mobility. We may conclude then that this is a natural, but not an indispensable phenomenon in the human species, and that if, on the one hand, it may facilitate labour in some cases, it is also capable of being transformed into a formidable disease, when it is carried to a very great extent, provided the female does not submit to the repose which may be necessary. Be this as it may, this relaxation of the posterior symphyses of the pelvis is especially useful, when the accoucheur is obliged to perform the section of the pubic articula-

tion ; indeed, without this it would be impossible to separate the ossa pubes beyond a few lines, without tearing or detaching the fibrous expansion which exists upon the fore part of the sacro-iliac articulation ; whilst this relaxation, be it ever so slight, always permits, without danger, a separation of almost an inch anteriorly, and that, so much the more so, because the anterior sacro-iliac ligament, being concave upon its pelvic aspect, permits the surfaces which it covers to remove several lines without being ruptured, since it admits of this separation by its curvature being drawn into a straight line, without any actual elongation of the ligament.

Furthermore, it is necessary to remark that, in these cases, as well as in all those in which inflammation and pus extend from the pelvis between the articular surfaces of the sacrum and os ilium, caries and necrosis are the speedy consequences. Is not this circumstance owing, in part, to the articular cartilage appertaining altogether to the sacrum, whilst the os ilium is entirely destitute of it, and not merely covered by a thinner lamina ?

Not only does the articulation under consideration become softened and relaxed in pregnant women, but the same thing is sometimes observed in children also : this phenomenon then constitutes a serious disease, and in which we see the corresponding abdominal extremity elongate or shorten several inches, by the slipping of one of the haunches upon the sacrum. This affection, without being very common, is not, nevertheless, very rare. L'Heritier has registered a singular case of this kind in *la médecine éclairée par les sciences physiques*, etc. published by Fourcroy, and M. Garengéot presented to our notice, one day, two similar cases in his hospital. It is not improbable that this disease has been more than once confounded with what is called a spontaneous luxation of the femur.

If it is true that the strength of the sacro-iliac ligaments renders the luxation of the sacrum upon the ossa innominata, or of the ossa innominata upon the sacrum, difficult, we are not the less constrained to admit that the articular arrangement of the former, and its relations with the organs which transmit to it the weight of the body, are extremely favourable to this displacement. For, it is certain that this bone, taken transversely behind and near its base, becomes broader and broader in proportion

as it approximates its anterior surface, and that it thus forms a wedge which tends to separate the iliac bones from before backwards, in the same manner that it forms another vertically, which makes an effort to sunder them from above downwards. Therefore is it not evident that, in falls upon the feet, for instance, it is very well disposed for the weight which the vertebral column bears upon it to make it tilt forwards? It is therefore incorrect to say that here the surfaces are so wedged into one another as to resist as energetically as possible the effort which tends to produce their luxation: on the contrary, it is rather a matter of surprise that this accident does not occur more frequently. With respect to that of the os ilium, it is actually almost impossible from behind forwards; but, in the vertical direction, a considerable number of examples of the kind are on record; one of the most curious of which, observed by Enaux, Hoin and M. Chausier, may be found among the *mémoires de l'académie de Dijon*.

From what has just been said it follows, that the sacrum is better disposed than the ossa innominata to resist efforts which are made from the centre to the circumference of the pelvis; whilst the ossa innominata, on the other hand, will more effectually resist external violence.

We will defer speaking of the ilio-femoral articulation until we have examined the different parts which enter into the composition of the inguinal region.

The following is the order of superposition of the parts in the principal points of the glutæal region:

Anteriorly, upon the anterior third of the fossa iliaca [externa], we find, 1st, the skin, of considerable thickness and but little extensibility; 2d, the adipose or subcutaneous layer, usually very thick, and enclosing but small vessels; 3d, the aponeurosis, dense and strong, forming a sheath anteriorly for the tensor fasciæ latæ muscle; so that we conceive it possible for an abscess to form in this species of fibrous case, by means of the supple cellular tissue which surrounds this muscle; unfolding also posteriorly at the anterior edge of the glutæus maximus, in order to expand upon its two surfaces; 4th, the glutæus medius, separated from the iliac and psoas muscles by a triangular space, which we will recur to in the region of the groin; 5th, superiorly, the os ilium; inferiorly, a small portion of the glutæus minimus, the os innominatum and the upper part of the articulation.

In the middle part we meet with, 1st, the skin, softer and more extensible ; 2d, the fatty layer, still thicker, and likewise much softer ; 3d, the glutæus maximus, covered by its thin sheet of cellular tissue ; 4th, upon one and the same plane, from before backwards, a portion of the glutæus medius and minimus muscles, the vessels and nerves of the same name, the pyriformis muscle, the great and small sciatic nerves, coming out from the pelvis, the superior gemellus, obturator externus and quadratus femoris muscles ; a little further behind, the posterior surface of the sacro-sciatic ligaments, the origin of the fibrous expansion which is spread over the posterior aspect of all these parts ; 5th, a portion of the fossa iliaca [externa], the ischiatic notches, and the posterior part of the coxo-femoral articulation, of the neck of the femur and of the trochanter major.

CHAPTER VII.

OF THE PELVIC EXTREMITIES.

THE inferior extremities, in like manner with the superior, pretty naturally divide themselves into six portions ; namely, 1st, a superior portion, which corresponds to the shoulder ; 2nd, the thigh ; 3d, the knee ; 4th, the leg ; 5th, the tibio-tarsal articulation ; and 6th, the foot.

ART. I. INGUINAL REGION, OR ANTERIOR AND SUPERIOR PORTION OF THE THIGH.

Strictly speaking, the glutæal region, or that of the haunch, should enter into the description of the abdominal member ; but as it seems more natural to connect it with the pelvis, we have not thought proper to deviate from the usual mode of considering it : consequently, the *groin* is the only region which we have to examine in the first segment of the pelvic extremity.

The limits of the inguinal region are not so exactly defined that all anatomists are agreed upon this point: some comprise under this name merely that groove which separates the anterior parts of the abdomen and of the thigh; others, and these the most numerous, thus call the triangular space which is circumscribed by Poupart's ligament, the sartorius and adductor longus muscles. We would have adopted the latter definition, if it had not obliged us to make an additional region for those organs which surround the obturator foramen, and to leave certain parts, which it would have been difficult to arrange externally. This, however, is a mere matter of form or convenience, and all that is important is for us to understand the meaning which we apply to this or that expression. This being granted to us, the inguinal region, in its greatest possible extent, will be limited, superiorly, by an oblique and slightly convex line, which would extend from the anterior and superior spinous process of the ilium to the outer side of the spine of the pubis; inferiorly, by a transverse or semi-circular line, the extremities of which would fall upon the tuberosity of the ischium and two inches below the great trochanter; externally, by the glutæal region, and internally by the pubic region above and the perineal below.

Upon its *surface*, in a thin but muscular man, we observe, when the limb is extended: 1st, above, the ligament which forms the superior boundary, 2d, below, a fold which passes from the anterior spine of the ilium below the ischium, in order to become continuous with the glutæal or sub-ischiatic groove. It is in this fold that crural herniæ manifest themselves; as it depends upon the movements of the thigh upon the belly, its depth is considerably increased during the flexion of this extremity; 3d, from without inwards, a vertical eminence, which points out the position of the tensor vaginæ femoris muscle; 4th, a second prominence, oblique inwards, produced by the sartorius; between these two eminences there is a triangular depression, with inferior base, of greater or less depth, in the bottom of which the rectus femoris muscle sometimes projects; 5th, a third prominence, more distinct than the preceding, oblique outwards and from above downwards, and which corresponds to the gracilis and adductor longus muscles: 6th, finally, between the latter and that of the

sartorius, a triangular excavation, with superior base, which constitutes the *inguinal hollow*, properly so called.

CONSTITUENT PARTS.

I. *The Skin.*

Upon the external eminences it is pretty thick and compact, becoming very thin and of a very lax texture in the inguinal hollow and the fold of the groin; on the inner side and upon the internal prominence it is thin also, but less extensible. The hairs of the pubis advance a little upon it, and numerous sebaceous follicles are imbedded in the depth of its laminae; indeed, we may say that these follicles, which sometimes secrete a very odorous matter, seem to dive even into the most superficial sheets of the subcutaneous layer. The fold of the groin renders it necessary that the skin should be divided, as much as possible, parallel to the direction which it presents if we wish to avoid unsightly scars after the operation for crural hernia, the evacuation of abscesses, of buboes, etc.

II. *The Subcutaneous Layer.*

This is a continuation of the general fascia superficialis, and consists of two species of laminae, one of which lies next to the skin, and includes the adipose cells; the other, deeper, having a more distinct membranous appearance and enclosing the saphena vein and the branches which pass into it; it also envelopes the superficial glands of the groin, and is pretty intimately adherent to Poupart's ligament, where it is continuous with the abdominal fascia superficialis. In consequence of this disposition, we find that, in fat subjects, the veins and lymphatic glands appear very deeply seated, whilst the contrary is observed in those who are emaciated. It also follows, from the union of the deep laminae with the crural arch, that, in crural herniae, the tumour is naturally compressed during the extension of the thigh, and that it is necessary to flex the limb when we wish to perform the taxis, or indeed the operation, when the tumour is strangulated.

III. *The Aponeurosis.*

Since Hesselbach, the diverse fibrous layers of the groin have been the subject of very numerous and important investigations, among which those of Sir A. Cooper, Hey, Colles, Lawrence, MM. J. Cloquet and Breschet, Scarpa, etc., are particularly distinguished, so that but little remains to be said on this point. We will, however, describe this aponeurosis according as we have met with it a great number of times upon the dead body.

In commencing with it upon the anterior margin of the tensor vaginæ femoris muscle, its two sheets unite and apply themselves upon the anterior surface of the rectus femoris, on the inner side of which it sends off a lamina of considerable strength, which slides between it and the psoas and iliac muscles, in order to become continuous with the articular capsule; at the external border of the sartorius, it splits for the purpose of enveloping this muscle, forming for it a complete sheath, which may be traced to the lower part of the thigh, and which terminates by a *cul-de-sac* at the anterior and superior spinous process of the ilium. These two re-united laminae then remain applied upon the fore part of the psoas and iliacus muscles, and are continuous above with the inferior border of Poupart's ligament, so that they unfold anew at the place where this ligament bifurcates, that is to say, towards the external third of its length. Of the two sheets which result from this splitting, the deepest dives still deeper, and sends a thick and strong lamina between the psoas and pectinalis muscles, before it reaches the external side of the femoral vessels. There, another lamella is detached from it, very thin and scarcely distinct above, much thicker below, which passes before these vessels, whilst the sheet itself glides behind them, covering the anterior surface of the pectinalis muscle throughout its whole extent, from the crista of the pubis, where it is continuous with the fascia iliaca, even to the lower part of the inguinal region. As it continues its progress it gradually rises, and finally becomes contiguous with Poupart's ligament above, and downwards and inwards with the superficial sheet. In this manner the aponeurosis of the thigh proceeds as far as the anterior margin of the gracilis muscle, at the same time constantly giving off lamellæ

which insinuate themselves between the different adductor muscles, the pectinalis, etc. At this place, its two laminæ again separate, in order to form a sheath for this muscle, behind which they become blended for the last time, forming but one layer as far as the ischium, where we will again find it in the posterior region of the thigh.

The other, or superficial sheet, which we left near the sartorius, separates from the preceding, passes before the crural vessels, and remains attached to the ligament of Fallopius, properly so called, of which it seems to be a prolongation; thus it proceeds to as far as about an inch on the outer side of the tubercle of the pubis, where it becomes blended with the deep-seated sheet, but in such a manner that its inner margin, that which is about to apply itself upon the anterior surface of the adductor muscles, in becoming united with the deep-seated layer, is extensively notched in order to form the external opening of the crural canal. This opening is of an oval form, the largest extremity of which would look downwards and outwards, and the apex under the external pillar of the ring of the obliquus externus. If we trace its circumference from this last point, we will find that it first makes a semicircular turn outwards and downwards, afterwards from without inwards and then rises from below upwards, as if its terminating extremity was disposed to slide under its point of origin; in such a manner, in fact, that it forms altogether a spiral turn, and that its axis falls obliquely, from within outwards, upon the antero-posterior axis of the thigh, under an angle of about thirty degrees; which it is of importance to recollect when we attempt the reduction of crural herniæ. Hence it follows that the portion of the superficial sheet of the fascia lata, which is above this orifice, is triangular, or rather falciforme; so that its superior margin is connected with the crural (Poupart's) ligament; that the external, is the point of departure of this sheet, and that the third forms the superior and external half of the aperture under consideration. This portion forms, besides, with the *ilio-pubic* (Poupart's) ligament, the anterior wall of the crural canal, which is consequently longer externally than internally. We will now readily perceive that the posterior wall of this canal is formed by the deep-seated layer of the aponeurosis, itself unfolded in order to enclose the vessels; that its external side,

which is about two inches and a half in length, directed obliquely from above downwards and from without inwards, is produced by the separation of the two fibrous laminæ; that its inner side does not, strictly speaking, exist, that is to say, that it only extends from the pectinated crest, or the ligament of Gimbernat, to just below Poupart's ligament, because the notch of the superficial sheet supplies its place in this direction; that its superior or abdominal aperture, which was studied in the iliac region, is elliptical, or rather oval, but in such a manner that its large extremity is turned inwards, and that its axis is parallel to that of the limb. This canal is filled, in the natural state, by the femoral vein and artery, which descend along its external side, whereby they lie on the external side of the inferior orifice, which, on the contrary, leaves a part of the anterior surface of the vein exposed at the point into which the internal saphena empties; by the deep-seated lymphatic glands, and especially by some cellular tissue, which prolongs the fascia superficialis into the belly, by uniting it to the fascia propria or to the sub-peritoneal cellular texture. It is this cellular layer which shuts the external aperture of the crural canal, and it is this which applies itself upon the viscera when they protrude, as well as upon the inguinal glands, whether tumefied or not: so that after these parts have been removed it appears cribrated; a disposition which has already been observed by Hesselbach, as may be observed in the plates of the groin which he has published. In fine, the crural canal is, in fact, only the continuation of the iliac fossa, divested of its viscera, of its peritoneum and of the other parts which occupy it. We may say that this fossa insinuates itself beneath the internal half of the femoral arch, in order to pass to the thigh, forming a canal the anterior paries of which is removed to constitute the opening for the saphena vein, and which terminates, below this aperture, in becoming continuous with the sheath of the sartorius muscle: hence this canaliculated prolongation may be considered as the pipe of the funnel to which we compared the separation which exists between the two walls of the iliac fossa. It seems to us, from the above method of considering these parts, that we may very easily comprehend how it is that serous, sanguinous or purulent fluids, extravasated in the abdomen, between the peritoneum and the aponeuroses, may make their way into the groin

and produce infiltration of the limb, or give rise to abscesses by congestion ; abscesses which it is advisable to distinguish from those which form more deeply, because, as they are most generally the product of a simple inflammation of the abdominal cellular tissue, they are not attended with the same dangers as the others, the cause of which is almost always a vertebral caries. It may also happen that these fluids, instead of escaping by the femoral orifice of the crural canal, in order to accumulate in the cellular layer beneath the skin, may continue their course downwards along the sartorius muscle, and form a collection at the lower part of the thigh.

The formation of femoral herniæ, their disposition, and whatever relates to them may now be readily comprehended. Let us first remark that the space which exists between the anterior and superior spine of the ilium and that of the pubis being greater in the female than the male, the abdominal opening is necessarily larger in the former ; whence it follows that femoral hernia is much more frequent in the first than in the second, so much so, that Morgagni, that excellent observer, and who has examined so many bodies, has never met with it in man ; he thus expresses himself : *Mihi, ut verum fatear, nondum nisi in fœminis accidit ut eam viderem* ; that Sandifort, Walter, Hevin, Arnaud have each met with it but once, and that Scarpa himself, who has so correctly described these parts in their protruded state, appears to have equally observed it in a small number of subjects only. Another anatomical reason powerfully concurs in increasing the relative frequency of crural herniæ in the female : thus, her inguinal canal is very narrow ; she has no scrotum for prolonging it to the exterior, and, besides, it is pretty exactly filled by the round ligament of the uterus ; whence it naturally results that, during violent efforts, the viscera cannot escape by this point as in man, that, on the contrary, they are repelled into the crural fossette of the iliac region, and penetrate more easily through the two openings of the femoral canal. Nevertheless, it must be noted that these peculiarities apply to the adult age only ; for, in childhood, the pelvis of the young girl differing but little, in relation to breadth, from that of the little boy, the inguinal canal, which is then, so to say, merely a simple ring in both sexes, renders inguinal and femoral herniæ almost as common, until the age of ten years, in the one as in the

other : it is only after puberty then that these differences are very great ; but, according to M. Dupuytren, it seems that they have been much exaggerated. In fact, this skilful surgeon has observed that femoral hernia is met with in one case out of ten in man, and that in the female inguinal hernia occurs about as frequently. Finally, we conceive that these two species of tumours may exist simultaneously in the same woman, an example of which Arnaud seems to have met with.

Be this as it may, crural hernia may be formed by the bladder, as observed by Levret and Verdier in a dropsical female ; by the womb in its state of vacuity, or during pregnancy, as seems to be proved by the case related by Sennertus, that of the Danish surgeon before referred to, etc. ; by the ovary, by the testicle even ; for we find, in the *Journal de Médecine*, for January 1809, the case of a young man of seventeen, in whom the operation was performed, where the tumour was produced by the seminal gland, which he had returned back into the canal at the age of seven years, and which afterwards had made its escape by the crural canal. This tumour may also be formed by the omentum, the cœcum on the right, or the S flexure of the colon on the left, but much more frequently by the small intestines, on account of their great mobility. On entering into the crural canal, the viscera which are displaced descend almost perpendicularly, and follow the same direction whilst passing through it ; but, on coming out from the orifice which is filled by the saphena, they pass from behind forwards and from without inwards, in a word, in the direction of the axis of this orifice ; so that, in order to reduce them it is necessary, in the first place, to press them from before backwards, not directly, as is generally advised, but according to the direction of the said axis, and afterwards to push them upwards and backwards. The taxis is generally difficult and very complicated in this species of hernia. In escaping from the inferior crural ring, the organs meeting with more strength and resistance in the fascia superficialis, downwards and inwards, than outwards and towards the crural arch, ascend into the fold of the groin between the superficial lamina of the fascia lata and the integuments, instead of continuing to descend, as in inguinal hernia ; they have been seen to pass in this manner even upon Poupart's ligament, forming a tumour very much elong-

ated ; hence, the hernial sac and its contents, in escaping from the crural canal, are bent to a more or less acute angle, in consequence of being folded back between the aponeurosis and skin. In this case, if the compression was made in the same manner as in herniæ of the first or second degree, it would, instead of returning the tumour, flatten it against the fascia ; so that, in order to accomplish the reduction, it must be pushed from above downwards and from without inwards, until it is brought on a level with the external opening of the crural canal. We may remark, however, that the parts do not always ascend in the manner just mentioned, and that the hernia sometimes descends very low, when it has become of considerable magnitude ; which must be a rare circumstance, however, because this form of tumour generally remains very small ; a peculiarity which is owing to the anatomical disposition of the crural canal. In fact, all the elements which enter into the composition of the inguinal canal, are, as we have seen, supple and more or less extensible ; they may be distended and the inguinal ring dilated by the gentle action which tends to separate its pillars ; in the crural canal, on the contrary, all is solid and unyielding ; the superior opening is formed by Poupart's ligament and the body of the pubis ; its parietes are altogether aponeurotic, and consequently of slight extensibility ; so that but a very small portion of the viscera can escape, forming a round and hard tumour, which is firmly supported by the deep-seated sheet of the fascia lata behind, and which is obliged to push forward and separate the different lamellæ of the fascia superficialis before : now, as the portion of this fascia which closes the aperture of the crural canal is generally very dense and presents diverse bands, (*brides*,) the tumour is thereby sometimes apparently divided into several distinct lobules. Finally, it is to this compact state of the tissues which the organs have to traverse or separate, as well as to the angle which they are most frequently obliged to form in coming out, that we must attribute the more ready and frequent strangulation of crural herniæ ; a strangulation which may, moreover, be produced, as in inguinal hernia, by the femoral opening of the canal, by its abdominal aperture, by the neck of the sac, by an epiploic band, and by a loop of intestine. If as MM. Breschet* and Dupuy-

* Thèse de concours, etc. 1819.

tren suppose, the first case is the most common, the division of the stricture would scarcely ever be dangerous, for it would always be sufficient to cut upwards and outwards upon one of the points of the concave edge of the falciforme process, which constitutes the superior semi-circumference of the opening, in order to obtain an easy reduction; and as the vessels are always posteriorly and externally, there would not be any risk of wounding them, if we took but a little precaution. M. Breschet remarks, on this occasion, that the incision of the external ring of the crural canal almost always permits the reduction of the parts, not only when this ring is the cause of the strangulation, but also when the constriction exists much higher, because, says he, the point of the falciforme process of the aponeurosis is directly continuous with Gimbernat's ligament, which is therefore relaxed by this incision. It is a fact that the semilunar border of this ligament, instead of being cutting and terminating abruptly, inclines downwards towards the thigh, and is pretty often continuous, without interruption, with the two sheets of the fascia lata, forming a gutter which constitutes the internal third of the canal; whence it follows that the opinion of MM. Dupuytren and Breschet is not so void of foundation as Scarpa seems to imagine. We do not mean by this, however, as the latter author has advanced, that the ligament of Gimbernat is rather an appendage of the falciforme process of the femoral aponeurosis than the simple expansion of Poupart's ligament; but, on the contrary, that the anterior and inferior border of this latter bandelet is continuous near the pubis with the two conjoined laminae of the fascia lata, whilst the triangular expansion of its inferior and posterior side is declined in its concave margin, after being attached to the crista of the pubis, so that the deep layer of the aponeurosis appears to be merely a prolongation of it. As, in all cases, the intestinal loop is naturally pushed by the movements and disposition of the parts against the cutting border, that is to say, against the external and superior semi-circumference of the inferior aperture of the canal, it is evident that the girding produced by this point may not unfrequently be the cause of the strangulation.

When the strangulation exists in the superior ring, there is nothing scarcely but the semilunar margin of Gimbernat's ligament that can occasion it, unless it should be produced by the inferior

border of the crural arch itself. Here, the celebrated Pott had already very properly remarked that the depth at which these parts are situated renders the division of the stricture a very delicate and a very dangerous step, especially in man. In fact, in whatever direction we guide the bistoury, it seems that we are in danger of wounding some important organ: thus, in cutting outwards and upwards, as advised by Sharp and M. Dupuytren, the instrument is carried precisely in the direction in which the epigastric artery is found. It must nevertheless be stated that the method adopted by the celebrated surgeon of *Hotel-Dieu* has generally been misrepresented; it is not, in fact, necessary to introduce a cutting blade under the crural arch, and divide the ring towards the spine of the ilium, by raising it; but to cut with a bistoury, having a convex cutting edge, first, the point of the inferior opening of the canal which compresses the displaced organs; afterwards, if required, the ligament of Poupart itself, by little and little, from its femoral towards its pelvic aspect, and from its inferior border towards the superior; by this method it is easy to avoid the epigastric artery, even when it is situated exactly behind the point which we are obliged to incise, whereas, by the other, we will almost inevitably strike it: there would be no exception to it, unless it is when the tumour has escaped by the *external crural fossette*, because then this vessel would form a semicircle upon the internal semi-circumference of the neck of the hernia. But M. J. Cloquet is the only person who has observed this fact upon the dead body, and we have mentioned that Scarpa and most modern surgeons deny the possibility of it, regarding the opinion of Arnaud, of Richter, of Sabatier, etc., as founded upon false appearances; for example, inasmuch as the hernia is sometimes thrown much outwards after its exit from the canal, because then it might lead to the belief that it had made its way out by gliding before or upon the external side of the crural vessels, although it had actually protruded upon the inner side of them. But, we have formerly observed that this species of displacement is not absolutely impossible, and that it is not difficult to introduce the finger upon the external side of these vessels, to make it slide even before them, leaving the epigastric artery internally; which circumstance, moreover, would not prevent the viscera from being found upon their inner side,

on passing out from the inferior crural ring; so that there would be no characters by which we might distinguish this hernia from any other. If we divide the stricture directly upwards, as was practised before Arnaud pointed out its danger, or upwards and inwards, towards the umbilicus, as Heister, Ledran, Sabatier, Lassus, as well as Chopart and Desault have recommended, when the tumour is situated very near the pubis, we run the risk of cutting the pubic branch of the epigastric artery in both sexes, and, besides, in man, the spermatic artery, and even the vas deferens. The testicular cord, in fact, is found on the outer side of the neck of the sac previous to its entrance into the inguinal canal; afterwards, in passing through this canal, it crosses the superior part of it obliquely from above downwards and from without inwards, since the external inguinal ring is nearer the pubis than the crural canal. During this tract, it is only separated from the viscera by the ligament of Poupart, which, being excavated like a gutter, possesses but a very slight degree of thickness; so that Scarpa does not believe, from the facts related by Arnaud, and the essays made at *Hotel-Dieu* upon the dead body by Verdier, Russel, Bassuel, etc., that we can make an incision of more than two lines upon the inferior border of Poupart's ligament, without wounding the spermatic vessels; but, it is evident that the apprehensions of this celebrated surgeon are exaggerated, and that he has drawn his conclusions from too small a number of subjects; it is certain, in fact, that, upon the most part of dead bodies, we may make an incision of three and four lines without touching the cord; and, as the disposition of the parts here is not changed by the formation of the hernia, we may infer the pathological state from the healthy state; we may also presume, as is admitted by M. Dupuytren, that the softness of the spermatic cord will permit it to roll under the instrument, and fly from its edge, if it should even strike it; besides, we might remove this cord from the bottom of the gutter which supports it, by raising it or drawing it inwards and upwards, as recommended by Sir A. Cooper. Let us note that, by cutting in this direction, if the epigastric artery was on the inner side of the neck of the tumour, we would almost necessarily divide it, because it would be drawn towards the median line by the displaced parts, and its curvature would thereby be more or less aug-

mented; so that, all things duly considered, it would probably be less dangerous to cut directly upwards, than obliquely inwards or outwards. When the obturator artery, originating from the epigastric, turns over the superior and internal semi-circumference of the hernia, in order to reach the obturator foramen, the division of the stricture by either of these three processes may still be dangerous: but, fortunately, this disposition is rare, indeed so very rare that, from Scarpa's calculation, it is not met with more than once in a hundred herniæ; and we think that this estimate is by no means improbable, because the obturator artery, in its descent, will not pass once out of twenty times above the neck of the tumour. Indeed, even then, it is almost always reflected backwards immediately after its origin, so as to pass behind the body of the pubis, in order to get to the obturator foramen; so that, if a crural hernia protruded through the ordinary passages, the organs would glide above this arterial branch and not below it.

Internally, the neck of the hernial sac being embraced by the semilunar margin of Gimbernat's ligament, which most frequently produces the constriction, it is natural enough to direct the incision upon it: therefore Mauchart, as far back as 1748, advised the division of the stricture parallel to the direction of the horizontal portion of the pubis, but merely with the view of avoiding the epigastric artery. Richter recommends the same process, which Mr. Hey also employd, but with a different intention from that of Gimbernat. The latter surgeon is the first who demonstrated that by grazing the body of the pubis, we might cut the triangular reflexion of Poupart's ligament to the extent of four, five and six lines without incurring the risk of wounding any artery, or of endangering the spermatic cord. It is a fact that the latter advantage cannot be disputed, and that, unless one of those anomalies exist in which the obturator or epigastric arteries are on the inner side of the tumour, there is an equal certainty of avoiding these branches; however, the pubic branch, given off by the epigastric, will generally be divided, if we are obliged to prolong the incision beyond a few lines, and its lesion might sometimes be followed by a serious hæmorrhage; by cutting obliquely downwards, separating, so to say, Gimbernat's ligament from the external pillar of the inguinal ring, as the Spanish sur-

geon recommends, we will almost uniformly avoid this arterial twig, much more certainly, at least, than by any other method. This method, then, seems to combine the most advantages, and we have reason to be surprised that it is not generally preferred, although Lawrence, MM. Boyer, Roux, etc., have long since adopted it. The only real inconvenience attending it is, that the incision is not always directed upon the most tense point of the superior crural ring, and, consequently, does not always produce a sufficient degree of relaxation, unless the division is carried to a very great extent. But this inconvenience is very slight, for we may without danger prolong the incision to the extent of five lines. Now, if, when the instrument is placed upon the concave margin of Gimbernat's ligament, we direct its cutting edge inwards and slightly upwards, as A. Cooper and Scarpa recommend, we see that this slight modification of the preceding process will annul several advantages, since we are then more exposed to wound the pubic branch of the epigastric artery, as well as the component parts of the spermatic cord. The celebrated surgeon of Pavia seems to have been well aware of this circumstance, for he very anxiously endeavours to shew that these inconveniences are easily avoided, if we take the precaution to make use of a straight bistoury with a convex edge; by which we may be enabled, he says, to cut the ligament of Fallopius from below upwards, and from its femoral towards its pelvic aspect, without being necessarily obliged to penetrate into the abdomen; so that the arteries, which are always separated from the posterior surface of the crural arch by some cellular lamellæ, may uniformly be avoided, even if they should be applied immediately behind the point which we are dividing.

It is evident that this method of operating, which bears a great resemblance to that advised by B. Bell, Pott and M. Dupuytren, is not more in favour of the direction which Scarpa gives to his incision than of any other, and that it is equally applicable to those of Sharp, Dionis, Heister, and Gimbernat. May we be permitted to say, on this occasion, that this idea does not seem to us to have been sufficiently appreciated, and that, by its means it would be strictly possible, especially in crural hernia, to cut in every direction without danger. In fact, the point of the bistoury held upon the pulp of the indicator, and di-

rected by the nail, may always be insinuated under the edge which produces the strangulation; even if we should not succeed in introducing it beneath, we might at least divide fibre by fibre, from the centre to the circumference, the fibrous ring which causes the constriction; so that the extremity of the instrument never passing beyond the extremity of the nail, all the parts which it is necessary to preserve will be surely avoided. It is useless to say that, in women, unless an anomaly exists, by cutting upwards, the small transverse artery of the pubis is the only organ of any importance that can be wounded, as the inguinal ring encloses the round ligament only, in place of the spermatic cord.

With respect to the strangulation of the neck of the sac, it almost always exists in one of the points of the length of the canal, because the superior opening of the latter, pressed by the viscera which endeavour to pass through it, is widened in the form of a funnel: whence it follows that, in order to relieve the stricture in such cases, it is not necessary to penetrate into the abdomen farther than on a level with the pectinated crista of the pubis, and, consequently, that we are rarely exposed to wound the arteries, unless we employ the concave bistoury of Pott, which is certainly, in this respect, the most dangerous instrument we can make use of. Whether the vessels, in fact, are internal or external, or whether they encircle the neck of the sac, as they are enveloped in the plates of the fascia propria, and repelled by the viscera in an excentrical manner, they will almost constantly be so remote from the circle which strangulates the tumour, that any other bistoury might divide it without reaching them; with Pott's bistoury, on the contrary, if we raise the extremity against the posterior face of the abdominal parietes ever so little, as surgeons advise us, it is very difficult to avoid comprising them in its curvature. It is true that the modification of Dubois and Sir A. Cooper, by leaving only four or six lines of cutting edge near its point, partly removes these inconveniences, by obliging the surgeon not to carry it too far into the abdomen; but, it will always tend to bring the arteries towards the point which we divide, instead of repelling them, like most other instruments.

In consequence of the resistance of the parietes and apertures of the canal, crural herniæ are strangulated more promptly and run on towards gangrene more rapidly than those which protrude through the inguinal canal: therefore the operation should generally be performed early in the former, if we wish to avoid the mortification of the intestine. It is long since experienced surgeons have made this observation, and every day we may renew it. We should be careful, however, not to generalise too much. In the month of June, 1825, we operated upon a woman aged forty-five years, of a strong and good constitution; the hernia had been strangulated five days, and the progress of the symptoms was very rapid. The intestinal loop was blackish, but presented no other signs of gangrene; after dividing the stricture the reduction was easy: much serosity was discharged from the wound during the first three days, and the operation was completely successful.

Six weeks afterwards we had occasion to perform the same operation upon another female, forty-eight years of age, of equally as good constitution, and whose hernia had been strangulated only twenty-four hours. After having divided the stricture, we easily, and without effort, drew out a pretty long portion of intestine, and then only did we observe that this viscus was perforated in two different places, upon the circle which had supported the constriction. This woman died the day following, and the autopsic examination shewed that the gangrene had invaded a great part of the small intestine. Therefore, since five days did not produce in one of these patients what happened to the other in a few hours, we should be cautious how we draw the conclusion, that gangrene is developed with too great rapidity in all crural herniæ, for us to calculate upon any chance of success after the strangulation has existed for some days.

The crural canal being situated in an excavation, instead of being supported by a relief, like the inguinal canal; its texture, besides, being very compact, it follows that the displaced parts are really pretty deeply situated, and therefore demand great precaution in attempting to slide the bistoury around them, if we wish to avoid wounding them. This disposition, doubtless, is also one of the reasons why crural hernia seldom acquires a large volume, and that the sac which encloses it can contain only

a small quantity of fluid; so that it is more frequently immediately applied upon the intestine, and consequently must be opened with the greatest precision. We should therefore prefer laying hold of it, as advised by M. Marjolin,* upon the bulgings which it presents, because in these points the surfaces are in less intimate contact with each other than in the intervals which separate them, and which frequently represent as many fibrous bands.

Finally, let us remark, that in cutting down to the viscera which have escaped by the crural canal, we must not expect to meet with the same layers as in inguinal hernia. The viscera, whatsoever may be the manner in which they are situated in the *middle iliac* or *crural fossette*, drive before them the peritoneum, which in its turn takes an envelope from the fascia propria; this last layer, in passing through the crural canal, carries before it the cellular tissue which fills this passage; so that it is already thicker in the middle of its length than when it entered it, and before it escapes from this canal the fibro-cellular web, which covers its external aperture, also becomes confounded with the fascia propria. Thus far the parts have progressed parallel to the axis of the limb; now, they are about to follow the direction of the axis of the external crural ring, leaving the femoral vessels and saphena vein externally; then the fascia superficialis applies itself over the preceding double envelope, and the skin covers the whole, an abstraction being made of the lymphatic glands which also surround the hernia, and of which we will speak hereafter. In the operation then, we have to divide, successively, the skin, which is generally so tense over the tumour that we cannot form a duplicature of it, and therefore we have to proceed as in all other simple incisions; next, the cellulo-adipose layer which varies so much in thickness that, in certain subjects, we fall almost immediately upon the sac, whilst, in others, we have to penetrate to a considerable depth. Some authors have indeed been obliged to cut from ten to twelve layers in succession before they have arrived at it.† Be this as it may, it is continuous without any very sensible line of demarcation with the cellular sheet of the peritoneum which envelopes the sac; it is this which encloses the lymphatic

* Thèse 1812.

† Rougemont traduct. de Richter, Callisen *Act. Societatis Hafniensis*, tome 1.

glands, the subcutaneous veins, and especially the saphena major, which is always driven behind and below the tumour, and frequently upon its external side; whence it follows that in making the incision in the direction of the fold of the groin, or parallel to the great axis of the hernia, we run no risk of wounding this great venous canal, which some persons have manifested an apprehension of; that by dropping a second incision perpendicularly upon the first, forming an inverted T, as recommended by Sir A. Cooper, we as certainly avoid it; but that by making a crucial division, as preferred by Dupuytren, it would be possible to cut this vessel in terminating the vertical portion of this double wound. Finally, we reach the sac after having met with several bands (*brides*), frequently some small hydatiforme vesicles and other organs which we will examine after a little. We see that instead of having six membranes invaginated within one another, as in scrotal hernia, there are, in fact, only three sheets, the skin, the cellular layer, and the sac, and that there is neither tunic of the cord, nor cremaster, nor fibrous tunic of the ring; finally, let us say that as, in the natural state, the peritoneum does not send any prolongation under the crural arch, hernia of this species can never be congenital.

IV. *The Muscles.*

The groin contains a great number of them.

(*a*) The *Sartorius*, descending from the anterior spinous process of the ilium, obliquely inwards, forms the external border of the inguinal triangle, and is separated from the tensor fasciæ latæ muscle by another triangular space, in the bottom of which is seen the rectus femoris. As it is completely ensheathed by the aponeurosis, it follows that if inflammation should be developed in the cellular tissue of this muscle and terminate in suppuration, the pus will be secreted into its fibrous canal, and will extend to the lower part of the thigh, without being extravasated into the surrounding textures. It is before it that the superficial, triangular, or falciforme process of the fascia lata separates from the deep-seated sheet, in order to pass anterior to the vessels.

(*b*) The *Gracilis* or *Rectus Internus* passes obliquely from within outwards, and, like the preceding, is enveloped in an apon-

eurotic canal, the deep-seated layer of which is much thinner than the superficial. It forms the internal boundary of the inguinal triangle, and we conceive that this muscle, as well as the sartorius, acting principally upon the leg, had need of a distinct fibrous sheath, in order to permit it to move freely, and without exciting the contraction of the other fleshy bundles of the thigh.

(c) The *Adductors* are so arranged, that the first, or median (*adductor longus*), originating external to the gracilis a little above the obturator foramen, passes, increasing in breadth, towards the posterior border of the femur, where we will again see it in the following region :

That the *second* or *brevis*, also originating from the pubis, but below the preceding, and equally on the inner side of the thyroid hole, is at first concealed, in addition, by the pectinalis, afterwards becomes situated upon the same plane with the two others, blending itself with their aponeurotic extremity in order to be inserted below the trochanter minor :

That the *third*, or *magnus*, forming a membranous expansion in the region under consideration, originating from the whole of the external labium of the ischion, and also from the origin of the ramus of this bone, passes behind the two former in order to attach itself to the outer lip of the linea aspera, from the border of the great trochanter to the lower part of the region, and even beyond it, as will be seen directly. It follows from this disposition that its fibres diverge as they proceed from the ischium, so that the superior are transverse and that those which follow become more and more oblique in proportion as they become more inferior ; it also follows that between the quadratus femoris and the adductor magnus a cellular space exists, which leads from the glutæal region into the sub-pubic portion of the inguinal region, and that the pus which should escape through the ischiatic notch might very easily form an abscess by congestion in the groin, and the more so as the three adductors and the pectinalis, in surrounding the obturator fossa, leave between them a sort of nidus, filled by cellular tissue, in which fluids might readily accumulate. These three bundles tend particularly to approximate the thigh to that of the opposite side, by drawing it towards the arch of the pubis : the first forms with the gracilis that ob-

lique cord which constitutes the inner boundary of the inguinal excavation, a cord which is very evident in thin persons, especially when we attempt to flex the thigh upon the pelvis at the same time that it is carried from the other, the leg being extended. The *magnus* is so concealed that its inner margin is not distinct in this region.

(d) The *Pectinalis* is almost entirely in the region of the groin: it is this muscle which forms the floor of the crural canal; originating from the crista of the pubis, covered by the deep-seated sheet of the fascia lata, its posterior surface constitutes the anterior paries of the sub-obturator cellular excavation, it consequently conceals the anterior part of the obturator externus, the nerves and vessels which issue from the pelvis by the sub-pubic foramen, as well as the viscera, when they protrude through this aperture. When we remove it, the aponeurosis being preserved, we see in its situation, upon the body of the pubis, a pretty deep *cul-de-sac* formed by the bone below, forwards and inwards by the external pillar of the inguinal ring, forwards and outwards by the inferior or pubic aspect of Gimbernat's ligament and of the deep-seated aponeurosis; so that the internal angle of this excavation corresponds to the spine of the pubis, and the external to the ilio-pubic eminence. We note this disposition, because by paying attention to it, it will assist us in comprehending the mechanism which seems to preside in the formation of the crural canal, and the exact relations of Poupart's ligament with the fibrous sheets which are attached to it. For instance, let us suppose the two laminæ of the fascia lata, the two sheets of the crural canal, the fascia iliaca and the fascia transversalis in contact, and that all the organs naturally situated between these fibrous laminæ do not exist, it will be easy to conceive how the two aponeuroses which line the interior of the abdomen, before and behind, being separated from above downwards, will give rise to the iliac fossa; how, in the next place, the same effort acting against the posterior surface of Poupart's ligament, but a little nearer its inferior than its superior part, will divide it into two semi-circles, of which, one much thinner, will be depressed and applied upon the os pubis, whilst the other, very solid, will follow the primitive direction of the ligament, so that this separation may form the superior crural ring; how.

finally, this same cause of separation continuing to press asunder the two laminae of the aponeurosis, will form the crural canal properly so called, and will terminate by perforating the anterior or superficial sheet of the fascia lata. It seems to us that by investigating these things in this manner there is nothing difficult to comprehend, and that the ligament of Gimbernat, among others, becomes an extremely simple object.

(e) The *Obturator Externus*, the deepest of all the muscles of the groin, filling entirely the obturator fossa, and attached to the membrane which forms the bottom of it, slides transversely over the *sub-cotyloid groove* of the ischion to its insertion in the digital cavity of the trochanter major; in the natural state it has a powerful tendency to turn the point of the foot outwards; in fractures of the neck of the femur, it makes a constant effort to draw the great apophysis of this bone against the ischion; posteriorly, it rests upon the adductor magnus; anteriorly, it is covered by the pectinalis and adductor brevis; and the obturator vessels and nerves pass over its anterior margin in order to reach the thigh; so that it is before it that the obturator hernia protrudes. We have already seen in the fore part of the cavity of the pelvis the commencement of the sub-pubic canal; we now see the external opening of it, which differs from the internal inasmuch as the superior border of the obturator externus muscle is not enveloped by an aponeurotic arcade or a fibrous sheet, like that of the internal; from which circumstance it is that the former may be easily depressed, and that the viscera, when once engaged in the sub-pubic canal, easily penetrate into the sub-obturator excavation. As this canal is naturally very narrow it does not seem susceptible of permitting the formation of hernia; therefore the possibility of these tumours was for a long time denied; but, they have been observed; first by Arnaud Senr. and Duverney, then by Garengot, who has recorded examples of them;* afterwards by Gunz,† Camper, Hevermann, etc.; by Sir A. Cooper,‡ and recently another case has been registered in the medical journals. In almost all of these cases the hernia is formed by the small intestine; but the epiploon has also been found in

* Mem. de l'acad. Roy. de Chir. tome 2d. † Libellus de herniis, &c.

‡ On Crural Hernia, p. 70.

it, and even the bladder, according to Gunz. The neck of the sac is surrounded, anteriorly and externally, by the sub-pubic osseous gutter, inferiorly and internally by the margin of the obturator muscles and the arcade of the obturatrix membrane: it is also in the latter direction that the vessels are met with; at least, this was their position in the subject examined by Sir A. Cooper. However, we conceive that they might also be found externally and even anteriorly, but not so easily, because they traverse in part the external obturator muscle. When they have once escaped from this canal, which is oblique from behind forwards and from without inwards, the organs are found immediately enveloped by the peritoneal sac, then by the cellular tissue of the sub-obturatrix excavation, expanded upon the fascia propria, with which it is confounded; afterwards, anteriorly, by the adductor brevis and pectinæus muscles; internally, by the adductor longus and gracilis, and posteriorly, by the adductor magnus; so that their deep situation generally prevents them from becoming prominent externally; or, the relief which they make lies so deep, that it might readily be mistaken for an abscess, as occurred to the surgeon who attended the man in *rue du Sépulcre*, of whom Garengeot speaks. Cases, however, have been met with in which this hernia was so voluminous as to make a considerable prominence in the groin; such was the first case which Garengeot observed, and that which Dupuytren has recorded in the *Medecine Operatoire* of Sabatier.* Be this as it may, this hernia is rarely strangulated, a circumstance the more remarkable as the posterior opening is unyielding and very narrow; but this peculiarity is so much the more fortunate, because the operation which, according to Malaval, has not been performed except by Arnaud, and that in a case in which there was no strangulation, would be extremely difficult and dangerous, and that the dilator of Leblanc, which Sabatier and M. Boyer seem to prefer to the bistoury, if ever this operation should become indispensable, would be of difficult application, and would produce but a slight effect upon the pelvic opening of the canal through which the organs have protruded. By the cutting instrument, we would have to divide successively on the inner side of the crural vessels, the skin, the fascia super-

* Tome, 3.

ficialis, the two sheets of the fascia lata, and another cellular layer applied upon the hernial sac, even when we would not be obliged to divide or separate from one another the adductor brevis and pectinalis muscles ; then, the sac being opened, the stricture can only be divided inwards and backwards, since the anterior and external third of the canal is formed by the os pubis. Now, we have said that the vessels are almost always situated internal or posterior to the neck of the tumour : consequently, it would be difficult to avoid the obturator artery, and as this branch is of considerable size, it would not fail to produce a dangerous hæmorrhage.

(*f*) The *rectus femoris* presents nothing remarkable here, except that it keeps separate from one another the sartorius and tensor fasciæ latæ muscles, the iliacus internus and glutæus minimus and medius. Let us remark, however, that it re-unites, by means of its reflected tendon, the aponeurosis of the thigh to the coxo-femoral capsule, which thereby becomes the common rendezvous of all the aponeuroses of the pelvic extremity, in the same manner that the scapulo-humeral capsule forms the principal centre of the fasciæ in the thoracic member. As it is, besides, immediately applied upon the fore part of the articulation, identifying itself, so to say, by its attachments with the capsule of this joint, it becomes one of the principal powers which oppose the luxation of the head of the femur upwards and outwards.

(*g*) The *triceps* (the vasti and cruralis) enveloping the femur at the base of its neck and of the trochanter major, presents nothing of surgical interest in the region of the groin.

(*h*) Lastly, the *psoas* and *iliacus* muscles united merit a very particular attention, on account of their relations with the aponeurosis and especially with the crural arch. We have seen in the iliac fossa, in fact, that Poupart's ligament, in passing towards the pubis, bifurcated towards the third of its length, in order to form the crural ring, and that the inferior branch of this bifurcation sunk down upon the ilio-pubic eminence in such a manner as to circumscribe a large opening, having one of its angles at this eminence, and the other at the anterior superior spinous process of the ilium ; an opening which is completely filled by the muscles which we are now examining, as well as by the anterior crural nerve, and which is soon transformed into a canal by the apon-

eurosis of the thigh: the deep sheet of the latter, in attaching itself to the ilio-pubic crest, forms at first a thick partition, which separates the nerve from the crural vessels, which partition or *septum crurale** is evidently continuous with the articular capsule, and which, in descending towards the trochanter minor, transforms itself into a fibro-cellular lamina between the iliacus internus and pectinalis muscles. This canal, which is a continuation of that which we have designated under the name of *iliac canal*, upon the fore part of the fossa of this name, appears to us to afford a solution of the difference in depth at which purulent depositions (*abcès par congestion*) are found in the upper part of the thigh, in different subjects. If the matters have actually been transported into the groin by the medium of the fascia propria, through the crural canal, it is evident that the abscess will be sub-cutaneous. If, on the contrary, the pus proceeds from a vertebral caries, and it infiltrates below the fascia iliaca, when it arrives at the thigh, it will be beneath the deep-seated sheet of the aponeurosis, and then we conceive that by gradually distending this lamina, as well as the internal septum of the iliac canal, it will push the vessels forwards and inwards, will form a more or less distinct prominence in the anterior and internal part of the thigh, and that, in this case, the fold of the groin will remain free in general. We also conceive that in time, these fibrous layers becoming very much attenuated might be destroyed, and finally permit the abscess to extend before the vessels, raising the falci-forme process of the fascia lata, in order to become superficial; or that, by perforating the septum which separates the iliac and psoas muscles from the pectinalis, or that which is interposed between the former of these muscles and the rectus, the pus will make its way into the sub-obturatrix excavation, between the adductors, and form a tumour under the ischion; or indeed externally, between the glutæi, triceps (extensor cruris) and tensor vaginæ femoris muscles, so as to project beneath the great trochanter; we also see, how the fluid of these sympathetic collections may extend throughout the whole thigh, and how it is possible to explain the successive appearance of a greater or less number of *dépôts by congestion* in different points of the circumference of the limb, as well as the sacculated form which these

* J. Cloquet, thèse 1817.

abscesses occasionally present ; how, finally, we might presume, from their deep-seated or superficial situation, whether they depend upon a disease of the bones of the spine, or psoitis, or whether they are merely the result of an inflammation of the sub-peritoneal cellular tissue.

It is worthy of remark that the bursa mucosa which exists between the anterior aspect of the fibrous capsule, the body of the pubis and the psoas and iliac muscles, although one of the largest in the system, and one of those upon which the muscles most frequently play, has as yet presented no morbid alteration, but in a very few cases, notwithstanding the great abundance of unctuous fluid which it usually contains. These two united muscles, in thus becoming reflected over the fore part of the articulation, give to it a very firm support, and are perfectly adapted to fulfil their functions with energy, which consist in flexing the thigh and turning it outwards, or in bending the spine and especially the pelvis upon the extremities : let us further observe that when they contract, the species of cord which they form on the inner side of the iliac fossa diminishes a little the superior strait of the pelvis, whence it follows that the legs and thighs of women should be slightly flexed during parturition.

As to the action of all these muscles, relatively to fractures and luxations, we will have occasion to take up the consideration of it when speaking of the skeleton.

v. *The Arteries.*

These vessels are very important, both on account of their diseases and the operations which we perform in this region.

(a) The *Femoral Artery* is found in the inguinal triangle, nearer the sartorius muscle than to those which form the inner limit of this space ; its direction is oblique from above downwards and from without inwards ; at its passage under the crural arch it is a little nearer the spine of the pubis than the iliac spine ; so that, in order to trace its course in the inguinal region, it would be necessary to place the extremity of a line upon Poupart's ligament at about two inches and a half on the outer side of the spine of the pubis, or two inches and three fourths to three inches on the inner side of the anterior and superior spinous process

of the ilium, and conduct it along the internal aspect of the thigh into the middle of the popliteal space. This artery, the calibre of which is from three to four lines, and the coats of which are half a line in thickness, is situated in the interval of the laminæ of the deep-seated sheet of the fascia lata, so that in order to expose its anterior face we must divide the skin, the fascia superficialis, the superficial sheet of the femoral aponeurosis, another thin cellular layer, and the fibrous sheath which immediately envelopes it; a sheath which gradually becomes thicker the lower we examine it, which is owing to the artery diving more and more in the aponeurosis in proportion as it descends; a sheath, finally, which opposes the mobility of this vessel, and which also includes its accompanying vein. Some lymphatic glands likewise surround this artery, and one of the branches of the crural nerve occasionally crosses it very obliquely. Posteriorly, it rests mediately upon the pectinalis muscle and the body of the pubis, the fore part of the iliac and psoas muscles, the head of the femur and the anterior surface of the adductors brevis and longus, from which it is separated only by a lamina of the deep-seated sheet of the aponeurosis. Externally, the same fibrous sheet alone separates it, superiorly, from the internal aspect of the psoas and iliac muscles, and inferiorly, from the triceps extensor and the body of the femur. Internally, it is every where contiguous with the vein which gradually turns behind it; in order to obliterate it, it must necessarily be compressed, against the body of the os pubis, upon the fore part of the head of the os femoris, or against the femur, between the triceps and the attachment of the adductors. In the first point, the artery is more moveable, because it is not yet engaged between the laminæ of the aponeurosis; but as it is only separated from the bone by the origin of the pectinalis muscle, we there meet with a very solid point of support; only, as the surface is inclined slightly forwards, it will be necessary to press obliquely backwards, especially as Poupart's ligament prevents the compression directly from above downwards. This compression may be produced by means of mechanical instruments, as for example with a counting-house seal furnished with a pad, or a simple roller bandage; but, whenever the arterial pulsations can be felt, the thumb is always the most sure; then it should be placed transversely, so that the whole of

the palmer surface of its last phalanx may be applied upon the vessel. By so doing, we may act with the thumb of the other hand upon the dorsal aspect of that which compresses, in order that we may alternate their use, according as the one or the other becomes fatigued.

This compression, if it was rendered permanent by means of Brayer's *bandage à pelotte*, made by the ingenious truss-maker M. Verdier, and brought into use by M. Dupuytren, although mediate, might determine the obliteration of the artery. It is well known that Guattani radically cured the patient in whom Maximini opened an aneurism, which he had mistaken for an abscess, by establishing an exact compression directly upon the artery by means of graduated compresses and a spica bandage.

A little lower down, that is to say, upon the head of the femur, this compression is much more difficult, unless the thigh is extended, and the same means are applicable to it in the same manner; only, it must be observed that cylindrical bodies will succeed better than upon the preceding point, because the artery being rather placed upon the fore-part of the groove which separates the pectinalis muscle from the iliac and psoas than upon these muscles themselves, it is less liable to roll, and the seal or the little ball (*pelotte*) enters pretty readily into this excavation.

Inferiorly, that is to say against the femur, the compression can scarcely be employed, except in thin subjects and those whose muscles are slender: then, it is necessary to apply the four fingers in the bottom of the inguinal hollow and the thumb on the outside of the limb, in order that the artery may be pressed from within outwards and from before backwards, against the femur, in the bottom of the groove which separates the internal portion of the triceps from the psoas and iliac muscles and the pectinalis.

In general, the femoral artery is so superficial in the groin that its pulsations may be felt through the skin; for which reason it is very easy to expose it, and it is also from this circumstance that this region has generally been preferred, since the publication of the works of Scarpa, for the application of the ligature. Nothing, indeed, can be more simple than this operation, when there is neither swelling nor infiltration; by cutting upon the inner margin of the sartorius, which slightly covers the vessels below,

we are sure of falling upon the artery ; and, even should the great saphena vein be found in this direction, we will never be deceived by it, if we recollect that it is subcutaneous ; whilst, in order to reach the arterial trunk it is necessary to divide, after the superficial cellular layer, at least one fibrous lamina and the proper sheath of the vessels. Let us observe also, that it is the incision of this sheath which constitutes the most delicate step in the operation, and that it should be made with the greatest caution ; that the most safe procedure is to tear, if we can, this canal to a small extent with the beak of the grooved director, (*sonde cannelée*,) or lay hold of and raise it with the forceps and make into it a slight opening, through which the director may be introduced, and guided by this the aperture enlarged to the extent deemed necessary. As the vein is always upon the inner side of the artery, it is necessary to separate these two vessels by passing the ligature under the latter from within outwards ; besides, we must not forget the nerve which crosses before it, and it is also important to recollect the exact number of aponeurotic laminæ, because if we pass beyond the deep-seated layer, whether internally or externally, we will lose ourselves among the muscles and with difficulty discover the artery.

When these different layers are more or less separated by extravasated or infiltrated fluids, but so that the parts are not displaced, still the operation will not be very difficult to a person possessed of the requisite anatomical knowledge ; it is in such cases that we must be directed by the line above pointed out, and that we should examine with the greatest care the different laminæ which present themselves under the instrument : but when, in addition to the swelling of the limb, a tumour exists, an aneurism, for example, which displaces and changes the principal relations of the organs, then the operation often becomes very delicate and extremely hazardous.

It is rare that anomalies exist in the disposition of the trunk of the femoral artery ; it has nevertheless been found, as frequently occurs in the humeral, to divide near its origin into two almost equal branches.* Gooch says that he has met with this anomaly even twice or three times, and Heister thought that all

* M. Casamayor, thèse, 1825.

those who recovered, after the crural artery had been tied in the upper part of the thigh, owed their recovery to this peculiarity.

(*b*) The *Arteria femoralis profunda* is the principal branch which maintains the circulation in the limb, when we apply, below its origin, a ligature on the preceding, from which it separates, in general, at two inches below the crural ligament, sometimes a little higher, at other times a little lower; immediately after its origin, it perforates the deep-seated aponeurosis, slightly approximates the femur, and winds in the cellular tissue on the fore part of the psoas and iliac muscles, then, as it enters the femoral region, it is again found upon the internal side of the artery from which originated, but always more deeply situated. It is indispensable to avoid applying the ligature on the femoral artery too close to it, for its volume would oppose the formation of the adhesive clot, and the coats of the vessels would be divided before they had become solidly agglutinated; so that, if the disease obliged us to place the ligature very high upon the crural trunk, at less than an inch, for example, below the origin of the profunda, it would be much better to apply it above this branch. The steps of the operation would not be more difficult in one case than in the other, and the numerous anastomoses which exist between the arterial canals of the pelvis and those of the thigh would permit the circulation in the limb to be re-established almost as promptly. Neither should we carry the ligature too high, for then the epigastric and circumflex iliac branches would give rise to the accidents which we are endeavouring to avoid. It is perhaps to this latter circumstance that we are indebted for the first operations of tying the external iliac. It is, in fact, not too unreasonable to suppose that, in Abernethy's patient, the first ligature was applied too near the profunda, whence hæmorrhage, and that the second was, in its turn, placed too near the epigastric, whence a renewed hæmorrhage, which obliged this skilful surgeon to carry the thread even upon the trunk of the external iliac.

Finally, if one of these branches was affected with aneurism, or divided in a traumatic manner, it would probably be the most safe and certain to tie the trunk of the crural itself. The principal arteries which derive their origin from the profunda whilst it is yet in the inguinal region, are :

(c) The *Internal circumflex*, which sometimes arises also from the trunk of the femoral: in all cases it passes backwards and inwards, turns round the neck of the femur immediately above the trochanter minor, between the obturator externus muscle and the common tendon of the psoas and iliac; afterwards, it passes between the adductor magnus and quadratus femoris, and is lost in the muscular bundle which goes to be inserted into the digital cavity of the trochanter major. Among all the numerous branches which are detached from it whilst passing through this tract, in order to be distributed to the muscles and anastomose with the arteries of the breech, thigh and perinæum, there are none so large as to require an operation, or to furnish a serious hæmorrhage when wounded; after the amputation of the thigh very high up however, it becomes necessary to tie the inferior ones, because the principal arterial trunk of the limb being obliterated, the impulse of the heart is more forcibly communicated to the branches. As for the rest, the internal circumflex artery is so disposed, that its trunk may be lacerated in fractures of the neck of the femur accompanied with considerable displacement.

(d) The *External circumflex*. This is frequently given off in common with the preceding, frequently also from the profunda, and sometimes from the femoral; it is very large and passes directly outwards, towards the space which exists between the psoas and iliac, the triceps (extensor) and sartorius, the rectus femoris and fascialis, in order to give to all these muscles branches which follow three general directions:—the first, descend between the rectus and sartorius, between the rectus and triceps, ramifying among these muscular bundles as far as the knee; the second, follow the transverse direction sending ramuscles to the tensor vaginæ femoris as well as to the termination of the glutæus maximus, and turns over the anterior and external part of the neck of the femur, in order to anastomose with the internal circumflex; the third, which ascend between the fascia lata, the glutæus medius and minimus, are lost in the region of these muscles. From this distribution it follows that a pointed instrument thrust perpendicularly into the fold of the groin, external to the femoral vessels, might penetrate the trunk, or one of the principal branches of the external circumflex artery and produce a serious hæmorrhage.

Next to these two principal branches, the *arteria profunda femoris* also gives off, before it abandons this region, the *perforans prima*; but, other arteries also originate from the crural, in this region.

(*e*) The *Epigastrica superficialis* (*tégumenteuse abdominale*) comes off from it some lines below Poupart's ligament, and immediately traverses the superficial sheet of the aponeurosis, in order to be distributed to the glands of the groin and to ascend into the iliac region; so that it is found exposed to the action of the instrument in the operation for crural hernia, and the ligature of the femoral artery at the superior part of the thigh; as it is usually very small, however, we are seldom obliged to tie it.

(*f*) The *Arteriæ pudendæ externæ* generally pass through the oval opening in the fascia lata in such a manner, that one passes before the vena saphena in order to go to the scrotum, whilst the other runs beneath this vessel, and remains applied upon the fibrous envelope of the limb in its course towards the same parts: whence it follows that the former only is wounded in the operation for crural hernia, and that both may be avoided when we tie the femoral artery, provided we do not remove too much from the sartorius muscle.

(*g*) The *Muscularis superficialis*, which generally arises from the external circumflex, sometimes from the femoral, immediately places itself between the rectus and sartorius muscles, where it would be necessary to seek for it after amputation, if its ligature should be required. We may observe that the deviations in the current of the blood, produced by the origin of these last four branches, are too inconsiderable to hinder the formation of the clot, when the ligature is applied near them upon the crural artery, and that, in this respect, we need not regard them.

(*h*) The *Obturator* (*sous-pubienne*) also appertains to the inguinal region, although given off by the internal iliac: in traversing the sub-pubic canal it gives off some twigs of but slight importance; but, there is detached from it a much larger branch which penetrates into the coxo-femoral articulation, for the nourishment of its cellular tissue and round ligament. If, in the obturator hernia, we should divide the stricture outwards and downwards, this branch might be wounded, and the extravasation of blood which would result from it might, at least, occasion the for-

mation of a deep-seated abscess. Afterwards, the obturator artery, by means of its two principal branches and their ramifications, penetrates into all the muscles of the inner part of the thigh ; so that its posterior branch anastomoses with the internal circumflex, the ischiatic, etc., and the anterior, which is the largest, sends several ramuscles forwards, through the intervals of the adductor longus and pectinalis muscles, ramuscles which it would be difficult to avoid in performing the operation for obturator hernia ; furthermore, it is this branch which more immediately runs along the inner side of the tumour. Both of them are so large as to require a ligature after the amputation at the joint.

VI. *The Veins.*

In the first place, there is at least one for each secondary artery, and they are all remarkable for their adhesion to the vessels which they accompany, and their numerous valves : which doubly favours the current of their fluids, but is of very little interest to the surgeon. The principal among the deep-seated, that is to say, the *femoral*, is always applied against the internal side of the artery, and a little behind it, consequently more deeply ; it is furnished with valves, and its volume augments in proportion as it ascends, and in a very striking manner, especially above the inguinal opening of the aponeurosis, by the confluence of the saphena and profunda veins. As it is enveloped in the same sheath with the femoral artery, it is equally exposed under the fascia superficialis, opposite to the aponeurotic aperture of the groin, and may be compressed in the crural canal by herniæ. From this circumstance, we may account for the infiltration of the limb which these tumours produce in certain subjects. Aneurisms must also occasionally produce the same effect, by the same mechanism.

In addition to the general reasons given for introducing the needle always by the side of the vein, when we wish to carry a ligature under the artery, rather than on that where the principal nerve lies, the crural vein also presents particular reasons : in fact, it is very large, very soft, and more deeply seated than the artery, so that in passing the needle from without inwards, it would be

very easy to perforate it; whilst, in the opposite direction, we readily isolate it, and by taking care to support it on the outer side with the extremity of the first two fingers, as M. Lisfranc* advises, we safely and easily pass the instrument beneath it, especially if, at the same time, we move its beak to and fro, in order to detach the parts. We may here observe, however, in relation to the ligature of arteries in general, that we should lacerate the tissues as little as possible, in order that we may avoid, as much as is in the power of art, the suppuration and inflammation which it occasions, because these are the two most frequent causes of the cutting through of the arterial tunics, and, without strictly adopting the ideas of English surgeons as it respects the smallness of their ligatures, we should at least endeavour to leave the parts in such a state as will admit of their most speedy re-union.

The superficial veins of this region merit a particular description.

The *great saphena (tibio-malléolaire)* vein is, in fact, the most remarkable of all the superficial veins of the body, both with respect to its volume and its relations with several capital operations. Placed in the deep laminæ of the fascia superficialis, it ascends obliquely inwards towards the opening of the fascia lata, into which it plunges, in order to inosculate with the crural vein, and in such a manner that the angle formed by this junction includes in the sinus which is below it the superficial layer of the aponeurosis, the notch of which is thus embraced by these two veins. At its entrance into the femoral vein, the saphena also receives the branches of the superficial epigastric and frequently the external pudic veins, so that it bulges out, as it were, and forms a species of sinus. It should be observed that their tunics are strengthened by the cellular sheet which closes the inguinal opening of the fascia lata, a disposition which may be easily explained with the assistance of a simple supposition, that is to say, by admitting that the saphena vein could not pass out of the crural canal without drawing with it this sheet, in order to form a sheath of it; or that this vessel is divested of it at its entrance into the external crural ring, where its parietes are, consequently, weaker and less resistant than elsewhere: hence, the saphena vein is, in this place, frequently very much dilated; a dilatation

* Taxil, thèse 1822, No. 142.

which generally coincides with more or less voluminous varices, in other portions of it, and of the subcutaneous abdominal veins. A globular, or cylindrical tumour may then result, which might be mistaken by the ignorant, or after a superficial examination, for a crural hernia: take for an example the bar-maid, spoken of by J. L. Petit, upon whom an empiric applied a truss for a tumour which was nothing more than a considerable bulging of the saphena at its entrance into the crural vein. This tumour might also be taken for an aneurism, on account of the pulsations which are communicated to it by the artery, if we did not pay attention to its softness, its superficial situation, to the diminution of its volume during the recumbent posture, or when compressed below; lastly, if there were not at the same time numerous varices throughout the whole limb. The saphena is also occasionally double at its entrance into the inguinal region, and its external branch, only, sometimes approximates near to the line in which the artery runs, but not sufficiently for us to apprehend wounding it when cutting upon the inner margin of the sartorius for the purpose of exposing the latter vessel; so that the apprehensions and reasons of Dr. Hutchinson,* which lead him to recommend the incision to be made upon the external margin of the sartorius, in order that it may be pulled towards the inner side of the limb, are destitute of foundation; and, independent of the difficulty of its execution, this method would even be attended with serious inconveniences; in fact, it would require a very extensive wound, a considerable detaching of parts, and, after the ligature, the artery would be found in a very deep *cul-de-sac*, the opening of which would be at the most elevated point of the thigh.

We have already seen that the viscera, in femoral hernia, cannot escape from the crural canal without depressing the saphena vein, and placing themselves before it, so that it would be somewhat difficult to wound this vessel in the operation which the strangulation of these tumours demand.

As this vein is not very remote from the femoral artery, which is external to it, and as it is separated from it behind only by the aponeurosis, it is evident that we should act very cautiously whenever we wish to make a longitudinal incision into, apply a liga-

* Letter on the operation for Popliteal Aneurism, 1811.

ture around, or excise it, as is occasionally practised for the varices with which it is so frequently affected. On the other hand, apart from this circumstance, it would appear that this operation must be attended with less danger here than in the other points of its length; because it is not surrounded by any nerve, it is free in the cellular tissue, and there is no important organ contiguous to it.

As it respects the *superficial epigastric* and *pudic veins*, the part which they perform in surgery is but trifling: it is necessary to know, however, that diverse tumours of the groin very rapidly occasion a swelling and varicose dilatation of them, and that, in the operations which the diseases producing their engorgement require, they sometimes embarrass the surgeon greatly by the quantity of blood which they pour out; this species of hæmorrhage, however, is rather annoying than dangerous.

VII. *The Lymphatics.*

Both the vessels and glands are here arranged in two distinct orders; one of which is situated in the subcutaneous cellulo-adipose lamellæ; the other, under the superficial sheet of the femoral aponeurosis, around the vessels and in the crural canal. The first receives the lymphatic vessels of the external genital organs, that is to say, of the testicles and penis, those which creep in the fascia superficialis abdominis, and almost all the superficial absorbents of the pelvic extremity; so that, on the one hand, medicaments applied by friction upon all these parts, react more or less promptly upon the subcutaneous inguinal glands; and, on the other, that these glands soon become engorged under the influence of the inflammations and suppurations which so frequently manifest themselves in these different parts: thus every body knows with what rapidity the venereal infection is transmitted to the glands in the groin, producing buboes. As these glands are enveloped in a supple and abundant cellular tissue, when they become inflamed, phlegmons frequently result, which sometimes terminate more or less promptly by suppuration. Then the abscess is almost uniformly formed at the expense of the cellular tissue, whilst the gland is simply swollen, sometimes softened, suppurated, but without being capable of producing the pus

which escapes from these cavities ; from which circumstance we may say that, in syphilitic buboes, for example, there are two series of pathological phenomena : the one primitive, products of the specific cause, are developed in the glands themselves ; the other secondary, modified perhaps by the former, but also acting as if they were produced by any other cause, have their seat in the cellular tissue. Sometimes the first phenomena predominate over the second, and at other times it is the reverse. If we admit these two orders of things, we will be able to explain very readily how it is that leeches in a great measure dissipate painful buboes, when employed during their acute stage, yet do not completely cure them without the use of mercury. In fact, antiphlogistic means properly applied may overcome the phlegmogenous action, but will not remove the specific cause, which only yields to its appropriate remedy. Be this as it may, it is important to arrest these inflammations early, if we wish to prevent the destruction of the cellular tissue ; a destruction which will not fail to commence as soon as suppuration manifests itself, thereby detaching the skin, which becomes extremely thin, livid, and will not adhere to the bottom of the abscess ? so that this burrowing, which has a constant tendency to extend to a distance, is one cause which opposes cicatrization until the disorganized skin is removed.

These glands, to the number of six, eight, or ten, are always collected in the inguinal hollow, around the saphena vein, or in the environs of the aponeurotic aperture ; so that they naturally occupy the point at which crural herniæ generally manifest themselves, and as they are sometimes affected with indolent chronic tumefaction, they might readily be mistaken for one of these tumours, if we did not refer to the characters which distinguish them. It is thus that the wise and learned Sabatier applied a truss upon a venereal bubo, thinking that he had a crural hernia to treat. As they are rendered immovable by the morbid process, and are bound down by the aponeurosis upon the fore part of the vessels, the pulsations of the artery may be communicated to them and lead to the supposition that an aneurismal tumour exists. Lastly, those which receive the lymphatics of the penis and other sexual organs, are seated in the fold of the groin :

therefore if an acute or chronic enlargement is situated a little lower down, we may be certain or at least very strongly suspect that it is not of a syphilitic nature.

The deep-seated glands, which are three, four, or five in number, surround the femoral artery, and are placed between the two sheets of the fascia lata: they communicate with the preceding by means of arterial and venous twigs and lymphatic trunks, which traverse the falciform process of the aponeurosis; so that this layer is sometimes, as it were, pierced with holes: hence several authors have called it the *cribriform plate* of the fascia lata. These small vessels are so many pedicles which, it would seem, must transmit to the deep-seated glands the diseases of the superficial more frequently than is really remarked; indeed it is somewhat singular to see buboes multiply under the skin and become stationary, without any supervening in the crural canal. These glands may become tumefied idiopathically, but also sympathetically, in consequence of a deep-seated disease of the extremity. In either case, as they are firmly locked in the canal, they soon give rise to more or less alarming symptoms, such as enlargement and torpor of the whole inferior extremity, by the pressure which they exercise upon the vessels; sometimes even they produce all the phenomena of strangulation, and to such a degree, that they have, more than once, led to the performance of the operation which this accident requires; and what is somewhat singular, in such cases, is that the danger has frequently been dissipated by dividing the stricture in the same manner as is done for hernia; the surest plan, however, in these cases, is to extirpate the inflamed glands.

As they are in more immediate contact with the vessels, especially with the artery, and more deeply seated than those of the first order, as they are covered by a very strong fibrous membrane, which prevents their mobility, when they become enlarged, they may much more readily be mistaken for aneurism, and so much so that even the most experienced practitioners might be deceived, especially if an infiltration of the limb exists at the same time. We might say the same with respect to crural hernia, with which their characters might be very easily confounded. It should also be observed that both the superficial and deep-seated lymphatic glands occasionally become swollen and inflamed during the existence

of a crural hernia, in which case their proximity to the tumour complicates the operation, sometimes in a very embarrassing manner. Small abscesses may even result from them, which we are obliged to traverse in order to arrive at the hernial sac. M. Breschet has related a very curious case of this kind in his *thèse de concours*.

VIII. *The Nerves.*

Their distribution is more or less variable, and the most of them are but of little importance.

(a) The *Inguino-Cutaneous* is found in the superior and external angle of the region, between the origin of the rectus, psoas and iliacus, the sartorius and fascialis muscles: it almost immediately divides into a considerable number of small branches which very soon perforate the aponeurosis, in order to distribute themselves to the subcutaneous layer and skin. It appears, therefore, that these are sensitive filaments.

(b) The *Obturator* exactly follows its accompanying artery: it is therefore useless to insist upon its disposition: as it is lost almost entirely in the muscles of the internal part of the thigh, we would be induced to think that it belongs more particularly to locomotion. From this distribution, and the situation which this nerve occupies in the pelvis, we may satisfactorily explain those dull pains and cramps which some women experience at the inner part of the thighs towards the close of gestation, or during parturition; and from its passage through the sub-pubic canal, we might easily account for similar phenomena, if they manifested themselves in subjects having obturatrix hernia.

(c) The *Femoral branch of the genito-crural* ramifies in the canal, and as it is lost in the cellular tissue and lymphatic glands which fill it, it is, consequently, found behind the sac in crural hernia: although small, it may be so compressed, however, as to occasion pains in the iliac fossa and loins; finally, all our precautions for avoiding it are useless, when we perform the operation for strangulated hernia.

(d) The *Crural Nerve*, separated from the femoral artery by the deep-seated aponeurosis or the portion of this fascia which separates the crural canal from the iliac canal, or by what M. J.

Cloquet calls the *septum crurale*, splits into several branches immediately after its entrance into the inguinal region, when it has not divided previous to its passage under the crural arch. Of all its branches, two only deserve attention in surgical operations;—these are the *saphenus internus* and the crural properly so called, which at first run very near each other, so long as they are both on the outer side of the artery, but which afterwards diverge in such a manner that the former passes to the inner side of the vessel, whilst the other remains on its external side, where it is enveloped by the laminæ of the fibrous sheath, sometimes quite externally, at other times a little posteriorly, and also occasionally crossing the anterior surface of this arterial trunk; a circumstance which should be recollected when we practise the ligature of the femoral artery in the upper part of the thigh. It should also be remembered, in this operation, that these two nervous branches, in certain cases, lie so close to the posterior surface of the artery, that they are not perceptible at the first glance, and might therefore be readily comprised in the loop of the ligature; however, this inconvenience may be easily avoided, by taking the precaution to slide the beak of the aneurismal needle in a proper manner under the arterial parietes.

With respect to the other branches of the crural nerve, it is sufficient to observe that they all enter, in diverging, into the muscles of the region, and that several of their filaments terminate in the skin. Relatively to the trunk or to the mass of its branches, we may remark that, being at first enclosed in the same canal which contains the iliac and psoas muscles conjoined, they are thereby found exposed to the immediate pressure of the most common form of abscesses by congestion, and that these tumours may thus occasion pains, torpor and even paralysis throughout almost the whole extent of the limb, without any disease of the spine necessarily existing. We may also note that these phenomena would be equally produced by a tumour of any other nature, developed upon the fore part of the coxo-femoral articulation, or even in the pelvis, by a luxation of the femur forwards and upwards, or by an aneurism of the external iliac artery, for example.

IX. *The Cellular Tissue.*

This element, which we find every where, and which performs so extensive a part in surgical diseases, is here found in great abundance. We have, first, the superficial layer, which intimately connects the sub-peritoneal cellular tissue to the subcutaneous layer of the thigh, by the crural canal; next, we should observe the mass which fills the sub-obturator excavation, and which is prolonged by as many layers into the muscular interstices, so as to communicate, on the one hand, with the ischiatic notch, by the interval which separates the quadratus femoris muscle from the adductor magnus; on the other, with the fore part of the pelvic cavity, by means of the sub-pubic canal. Thus is explained the transportation or the propagation of inflammation and its products from one of these points to the other.

In the third place, we must notice the cellular train which surrounds the psoas and iliac muscles in their fibrous canal, which canal also terminates by becoming converted into cellular tissue; this species of lamellated centre, separated from that of which we have just spoken by the deep-seated fascia, communicates more directly with the layers which fill the spaces between the tensor vaginæ femoris, sartorius, rectus, triceps (extensor) and glutæi muscles. It is by its means that the sub-aponeurotic purulent abscesses of the iliac fossa make their way to the groin; and as there exists a middle layer of some thickness opposite the trochanter minor, between the deep-seated sheet of the fascia lata and the anterior surface of the pectinalis, adductor brevis, iliacus and psoas muscles, we conceive it possible that abscesses of the iliac canal may pass into the sub-obturator excavation, and *vice versa*. This is, indeed, what frequently happens in the *depôts by congestion*.

X. *The Skeleton.*

It comprises the cotyloid cavity, a part of the ischium and of the pubis, and the superior fourth of the femur: to these we must also add the whole of the anterior border of the os innominatum (os coxal) as far as the pubic region. It is, at least, important to

remark that this border being deeply concave, forms with that of the opposite side, including the superior part of the pubes, an extensive notch, filled by the abdominal parietes only, and which explains the reason why the womb so easily inclines forwards during pregnancy.

The cotyloid cavity being very deep, it follows that the greater part of the head of the femur is enclosed within it, and that in this respect it differs from the glenoid cavity; the central point of union of the three pieces which compose the os coxal in early life, it then presents a cartilaginous triangle, a sort of *y* which permits the rupture of it; encrusted in its superior four-fifths with a smooth and polished cartilage, and receiving in the rest of its extent a cellulo-adipose mass, which is considered by Cl. Havers as the secretory organ of the synovia; forming, besides, a perfectly rounded *cul-de-sac*, the entrance of which is circular, it permits, on the one hand, movements in all directions; on the other, it supports very well the weight of the body without fatigue, and without compressing the cellular cushion which encloses the vascular and nervous parts; finally, containing more soft parts than any other, it follows that it inflames very easily. Then, without saying with J. L. Petit, that the synovial fluid, accumulated in this cavity, expels the head of the femur, we must admit, however, that this bone is then driven outwards, but only because the cartilaginous surfaces have become turgid and all the ligaments are softened or disorganized.

It is slightly notched out forwards and upwards, upwards and backwards, and deeply downwards and forwards; and these notches, although surmounted by a fibrous collar, which effaces them in a great measure, favour, in a manner quite special, luxations in these three directions; the cavity, besides, is surrounded by a fibrous capsule little susceptible of elongation, and of a very compact structure. Displacements are thereby rendered very difficult, so that they can only take place after a rupture of this pouch, which is, moreover, much weaker posteriorly than anteriorly, where its resistance is also much more necessary. Be this as it may, if the *luxation* takes place *forwards*, the head of the femur raising the psoas, iliacus and pectinalis muscles, the crural nerve, the vessels and the aponeurosis, is drawn upon the triangular facet of the horizontal portion of the pubis; it cannot be

carried or retained more externally, on account of the ilio-pubic eminence, and because the notch which separates this eminence from the anterior and inferior spine of the ilium is much more elevated than the pubis: neither can it ascend higher in the pelvis nor pass more towards the median line, because the neck of the femur, on the one hand, and the trochanter major on the other, stop it by hitching against the borders of the acetabulum, or the external surface of the ischion. In this state the limb is turned, the point of the foot directed outwards, by the simultaneous action of the glutæi and of all the bundles which are inserted into the digital cavity of the great trochanter. This luxation cannot exist without a shortening of the limb, and we see that it may give rise to severe symptoms by compressing the crural nerve and vessels. If this *displacement* takes place *downwards and inwards*, there is, on the contrary, an elongation of the limb, since the head of the bone is then found placed in the obturatrix fossa which is below the cotyloid cavity; the direction of the inter-articular ligament is then oblique from above downwards, instead of being so from below upwards; but it is not necessarily ruptured, as in the preceding case. We do not mean to say, however, that this cord always remains entire; on the contrary, it must be torn most frequently during the excessive degree of abduction which precedes the displacement. The head of the bone being enveloped by the obturator externus muscle in the obturatrix fossa, does not compress any important organ, and if the reduction is not effected, we conceive that the sub-pubic membrane may then become ossified, an accidental cotyloid cavity formed, and the patient finally be able to make use of his limb, which, however, will always remain turned outwards, on account of the tension of the adductor muscles.

In order that the *luxation outwards* may take place, whether it always should appear at the same time superior primitively, or sometimes might be inferior at first, so great a degree of adduction is required that the disposition of the thighs will not easily permit it, and, besides, the brim of the acetabulum is so much raised and the capsule so strong in this direction, that we must not be surprised at the infrequency of this displacement. As the head of the femur slides between the glutæus minimus and the dorsal surface of the os coxal, upon which it rests, the glutæus

maximus muscle and the other internal rotators turn the point of the foot inwards. In the last two species, the sartorius, rectus, psoas muscles, etc., being put upon the stretch, and the femoral extremity (head) being placed upon a point posterior to that which it naturally occupies, it follows that the limb must be carried more or less in the state of flexion.

Let us remark, that the bottom of the acetabulum is so thin, that it would be very easy to perforate it in disarticulating the thigh, and thus plunge the point of the knife into the pelvis; that, on the other hand, caries or necrosis may traverse it also, as too frequently happens in severe coxalgia, and that if the pus does not then escape into the cavity of the pelvis, it is because the soft parts which line it become thickened and indurated in proportion as the disease advances, and thus oppose to it a more or less solid barrier; but which is not, nevertheless, insurmountable. There is still another remark to make on the cotyloid cavity: we know that, after unreduced luxations, as well as in consequence of the disarticulation of the femur, the acetabulum gradually contracts and finally becomes almost completely filled up; now, at the same time that these phenomena are taking place externally, the corresponding points of the interior of the pelvis seem to be drawn inwards, and carried backwards, in fact, in such a manner as to diminish one of the oblique diameters of the superior strait; whence it follows that, in women, these changes might become the cause of unnatural labour. The same thing is also observed after amputation of the thigh in the continuity of the limb, because the cotyloid cavity no longer having any thing to support, withdraws, so to say, into the pelvis. This last observation was long since made by Herbiniaux upon pregnant women, and Mdme. Lachapelle has recently confirmed it, by the examination of a woman in whom amputation had been performed several years previous, and who died in labour at the Maternité.

In the femur, it is necessary to notice, in the first place, the disposition of its neck relatively to the rest of the bone. The cervix femoris is about two inches and a half long inferiorly, or upon its *gorge*, and one inch only superiorly, between the articular head and the trochanter major; so that there is less space for passing the knife in the latter direction than in the former. The angle which it presents being less prominent in children

than in adults, it follows that, all other things being equal, its luxations are more readily produced in early life. It is, in fact, this very remarkable bend in the bone of the thigh, joined to the depth of the acetabulum, as well as the strength of the orbicular ligament, which render these displacements so rare. Does the luxation tend to take place outwards, it is necessary that the head of the bone, the centre of which looks inwards and upwards, should pass over the whole extent of the cavity which encloses it, so that the adduction of the limb may be carried almost even to the point of forming a right angle with the trunk before the surfaces could abandon one another; and this must be understood of the whole internal semi-circumference of the articulation. In the external half, it is true, the abduction cannot be carried very far without the head of the femur tending promptly to escape, since it is already very much inclined in this direction; but, then, the superior part of the neck is soon checked by the border of the articular cavity, at the same time that the trochanter major strikes against the external surface of the ischium.

Furthermore, this angle is also attended with the advantage of enlarging transversely the base of support, and, of thereby giving more solidity to station; by separating the upper part of the thigh bones, it has permitted nature to collect in this interval the greatest number of the muscles of the thigh, and all the organs which had need of being protected by these bones: thus, the sexual parts, the vessels and nerves are sheltered by the prominence of the great trochanter. But, on the other hand, this angular union of the body of the femur with its neck, favours greatly the production of fractures; in fact, from a fall upon the feet, for example, the weight of the body, increased by the fall, descends upon the head of the os femoris, and tends to force it downwards, whilst the trochanter major, by the resistance of the ground, is repelled towards the crista of the ilium; these two opposite efforts upon the two arms of an angular lever, could not act in a more advantageous manner in order to determine the fracture of it. When a violent blow is made upon the external surface of the trochanter major, or a fall is received upon this eminence, the two powers represented by the weight of the trunk on the one part, and by that of the limb on the other, will

have a powerful tendency to produce the separation of the two branches of this angular lever, since its elbow is thereby obliged to serve as the point of support.

The neck of the femur being very broad near the body of the bone, and, consequently much thicker from above downwards, (the direction which the fracture must take,) than near to the cartilaginous sphere, we may thence infer *a priori*, that its solutions of continuity must be more frequent at this latter point than in the former: now, this circumstance is far from being advantageous, for as the periosteum becomes thinner and thinner in proportion as it approximates the cartilage, it consequently results that consolidation will be much more difficult and tedious. Indeed, many authors have affirmed that a bony union is impossible in these cases, because, say they, the osseous head no longer forms but a foreign body in the articulation: but they had not reflected that the inter-articular ligament contains a great quantity of vessels, and that it supplies more, perhaps, for the vitality of the bone than the periosteum itself; they had also forgotten that the synovial membrane encases the cartilage, and that even in the groove which unites the articular head to the cervix, properly so called, the fibrous capsule still exists; that moreover, it is there covered by the cul-de-sac of the synovial membrane, which contains in this situation distinct clusters of a reddish cellular tissue. Nevertheless, it must be admitted that, by the progress of age, these tissues, alone capable of promoting the inflammation, gradually waste; so that, in some old people, the reunion of the two fragments is actually impossible, and if death does not soon follow this fracture, the head of the femur is worn away by the friction, and finally no longer forms but an osseous cap which daily becomes more and more attenuated.

If the fracture takes place more externally, it is possible for the fibrous expansion to maintain itself upon the two fragments without becoming lacerated; and if, in this case, the rupture is unequal, that is to say, if there are points and depressions which reciprocally interlock with each other, it will sometimes happen that the patient will be able to make some steps immediately after the accident, and that certain fractures of the neck of the femur may exist without displacement, of which several well attested cases are recorded: but, we conceive that these cases must be

very rare, and that we will scarcely meet with them except in fractures of the second species, that is to say, in those which occur from a fall on the haunch, because, in those which follow falls upon the feet, the cause which produces the solution of continuity of the bone seldom fails to carry along with it a greater or less displacement of the fragments.

We also conceive that when this displacement is once effected, it must be very difficult to overcome, and that, if it is easy to restore the limb to its natural length, nothing proves that the fractured surfaces are in exact coaptation. In fact, the head of the femur, fixed in the acetabulum by the inter-articular ligament only, then enjoys a degree of mobility which nothing can restrain; art possesses no means of acting upon this fragment, which will necessarily incline to one side or another from the slightest pressure which the inferior portion may exercise upon it. Nevertheless we think it possible, by the occurrence of certain circumstances which cannot be foreseen, that the two fractured extremities may be so exactly maintained in contact that it will be difficult to perceive, after the cure, that any solution of continuity had existed. We have seen a specimen in the possession of Dr. Thierry, which might certainly lay claim to the 2000 francs proposed by the professor of Montpellier.

Furthermore, this displacement is never carried to a very great extent, unless the capsular ligament is torn, or the fracture exists very near the body of the bone; we may thereby explain how it is that fractures of the neck of the femur are cured almost in the same manner even by means of dissimilar apparatus: thus, whether we fix the patient to the head of the bed by means of bandages passed round his chest, under the axillæ, whilst the extension is made upon the foot by more or less heavy weights, as was the custom of the ancients; or make use of Desault's long splint, with or without the numerous modifications it has undergone in the hands of many surgeons; or employ the more complicated, more certain, and more solid mechanical apparatus, invented by M. Boyer; or compress the limb firmly between two strong and thick splints, as recommended by Dr. Canin; or content ourselves with applying a simple retentive bandage, and exercising every day some tractions upon the foot, in order to fatigue the muscles, until the process of reunion has acquired a

considerable developement, as was the practice of Foubert and Sabatier; or whether we simply take the precaution to fix the injured limb to that of the sound side, in order to oppose its lateral eversion; or, finally, what is still better, put the different muscles in a relaxed state, by keeping the leg and thigh in a semi-flexed position by means of a double inclined plane placed under the ham, a practice which has long been employed by M. Dupuytren and many English surgeons:—in all these cases, the consolidation will take place, but always with a shortening of the limb, which will be not much more considerable by one process than by another. In fact, the most ingenious machines cannot act in a sufficiently uniform manner for the space of two months; the points of support upon which the powers of extension are applied can never be so immoveable as to prevent the glutæi muscles from finally drawing in a greater or less degree one of the osseous fragments upon the other; and, as the action of these muscles, reduced to their simple tonic contraction, can only produce but a slight degree of crossing, which is also checked by the capsular ligament, it thence follows that the difference in the results cannot be very great, whether we abandon the limb to itself or keep it in a state of permanent extension.

As the glutæi, obturatores, gemini, pyriformis, quadratus, psoas and iliacus, adductor brevis and pectinalis are all inserted into the superior part of the thigh bone, in such a manner as to turn it outwards, if it was not retained by the cotyloid cavity, and as this resistance no longer exists after the fracture, it follows that the external rotation of the point of the foot and the knee, which we then observe, is a phenomenon altogether natural: therefore it still remains to account for the facts observed by A. Paré, J. L. Petit, Desault, M. Roux, etc., in which the same parts were turned inwards.

It is also important to remark that the fibrous capsule is disposed in such a manner upon the narrow part of the bone, that if it is divided circularly upon the cervix femoris, it will not permit the articular head to escape from it without a considerable effort; so that, in order to avoid great difficulties when disarticulating the thigh, it is indispensable to make this section very near the margin of the acetabulum, taking care to cut it perpendicularly upon the head of the bone. Without this precaution,

in fact, the ligament will double under the edge of the knife and thereby be cut with difficulty and incompletely. But, it is then necessary to recollect exactly the plane of the cotyloid cavity, and the axis of the femoral head: viz. that the former looks obliquely downwards and outwards, and that it is perpendicularly traversed by the second in its centre. Furthermore, it should also be noted, in relation to this amputation, that the trochanters remain cartilaginous in children for a long time; so that, as M. Lisfranc says, in making the flaps in subjects under the age of ten or fifteen years, we need not apprehend being stopped by these processes. As to the femur itself, between the two trochanters, it presents nothing remarkable relatively to fractures, unless it is that the superior fragment will be drawn backwards by the glutæus maximus, whilst the psoas and iliacus muscles, then inserted into the inferior fragment, will tend to make it overlap forwards. With respect to the operation just mentioned we must observe that, internally, the body of this bone forms, in uniting itself with the neck, a deep *gorge*, upon which the knife must be carried in order to form the first flap, when we adopt the method of M. Larrey, and the second, when we imitate M. Lisfranc. Externally, on the contrary, it is convex and sub-cutaneous below the trochanter major, and presents only a narrow notch between this eminence and the external face of the cotyloid cavity; whence it follows that the external flap is always thinner externally than internally, and that, if we commence by forming this flap, we are more liable to be embarrassed much longer than if we should begin with the other. But, in order that we may judge of the respective merits of the most celebrated methods for disarticulating the femur, we should recollect the relative disposition of the soft parts. Thus, by plunging a knife perpendicularly two inches below the anterior and superior spine of the ilium. into the excavation which exists between the fascialis and sartorius muscles, we fall upon the femur at more than an inch on the outer side of the vessels; afterwards by inclining its point a little inwards, we slide it upon the *supra-trochantineal gorge*, and then nothing is more easy than to make it pass out at the subischiatric groove. By terminating the flap in this manner, we can only be stopt by the trochanter minor, which may be easily avoided by carrying, from this moment, the edge of the knife a

little inwards, so as to divide, from the bone towards the skin, the pectinalis, iliacus and psoas muscles, the crural nerve, artery and vein, as well as the deep femoral artery, the sartorius muscle, the three adductors and the gracilis. Then, the articulation being almost denuded in the upper part of this flap, it will be easy to make a semi-circular incision through the capsule, luxate the bone, divide the internal ligament, traverse the joint from within outwards, and arrive at the trochanter major, to the external surface of which the skin is so adherent, that this flap will there be very deeply notched, unless we pay the greatest attention. This method would be without contradiction, the most simple and expeditious, if it did not previously require the ligature of the femoral artery near Poupart's ligament, and if the external flap was not always much thinner than the internal. It is true that we might possibly dispense with the application of this ligature, by compressing this vessel against the body of the pubis, or the iliac artery through the abdominal parietes, or even the aorta upon the vertebræ; but in addition to the uncertainty of suspending the current of the blood by this means, where the operation is protracted, it should also be observed that as the flap is cut below the origin of the arteria profunda, we would be obliged to search deep among the muscles, in order to reach the femoral above this branch.

By operating according to M. Lisfranc's method, that is to say by making the external flap first, and afterwards the internal, previous to the disarticulation, we may avoid the preliminary ligature or compression, because it is possible, after having carried the knife close along the neck of the femur, before turning its edge from the trochanter minor, to thrust the thumb into the wound, above the back of the instrument, in such a manner as to grasp the artery between it and the other four fingers, which are applied upon the cutaneous surface of the flap. This modification is certainly advantageous; but, the last inconvenience which we have noted, when we do not exactly follow the steps laid down by M. Larrey, persists, and besides it seems to us that the operation is more tedious and difficult for those who are not in the habit of exercising themselves upon the dead body.

By making the flaps in such a manner that one of the angles of the wound is inwards and a little before the tuber ischii, whilst

the other is below the spinous process of the ilium, as advised by MM. Sanson and Bégin, we have the advantage of giving to them nearly equal thickness, without increasing the dangers or the facility of the operation. The base of these flaps may also be brought into more exact coaptation, because the soft parts are more distant transversely than from before backwards, on account of the trochanter major.

It is unnecessary to find fault with the circular method which Abernethy and some other surgeons of Great Britain prefer. But is not the method of Guthrie and Graefe, which was also invented by Bécларd, and which consists in making two semilunar flaps, as in the process of MM. Sanson and Bégin, with this difference, however, that they are made from the skin to the femur instead of from the femur towards the integuments, preferable to all the others? It presents the immense advantage of producing a wound, the two lips of which are very regular; we may also commence the incision of the skin a little lower than we wish to cut the muscles; besides, we know what we are about, whilst it must be admitted, that, in operating from within outwards, we proceed more or less fumblingly, until the knife has passed through the soft parts. What we have here advanced in relation to the coxo-femoral disarticulation, may also apply to all flap operations; whenever, in fact, we commence by plunging in the knife in order to transfix the limb, we are under the necessity of making strokes with the point (*des coups de point*), as Professor Marjolin says, and are thus exposed to deviate in the substance of the soft parts: by proceeding in the opposite manner, we are less expeditious perhaps; but is it in the character of a surgeon worthy of this title, to seek a vain éclat at the expense of his patients? and can a few seconds more be put into the scale against the safety of a capital operation? With respect to the artery, we may compress it in this case, in the same manner as in the others; but in all, we think that its ligature, previous to the amputation, is attended with so little difficulty, that we should not lose the advantages which are to be derived from it. The limb being removed, some branches of the ischiatic, gluteal, internal pudic and obturator arteries will be found in the external flap: arteries less numerous, given off by the same branches, and sometimes from the external pudic, will be seen in the internal

flap, whenever the femoral artery has been previously secured ; in the contrary case, we will have, in addition, some large and numerous branches derived from the two circumflex arteries of the thigh, in the first direction, and, in the second, the femoral and profunda only, because, the last two being tied, the circumflex, pudic, perforantes primi and the superficial muscular which arise from them, will naturally cease to pour out blood, so that, apart from these two trunks, the hæmorrhage is not actually proportionate to the extent of the wound.

In conclusion we may also say, that, by all these methods, which are in fact only more or less happy modifications of that of M. Larrey, it is possible to perform this operation, at least, upon the dead body, but upon the living, there is not one of them which is applicable to all cases, because then the soft parts are generally more or less lacerated, and do not permit us to make the flaps as we would wish, so that we are obliged to act according to circumstances: this reason, which is applicable to all surgical operations, should induce the young surgeon to perform and make himself familiar with every method upon the dead subject.

In reviewing the inguinal region in the order of superposition of its parts, we may examine it at the internal eminence, in the inguinal hollow and upon the external prominence.

In the first situation, we find, 1st, the skin, delicate, smooth, covered with hairs above only, and of limited extensibility ; 2d, the subcutaneous layer, often containing fat, which is generally very firm, and traversed by the external pudic veins ; 3d, the aponeurosis, single and pretty thick ; 4th, the adductor longus, gracilis and adductor brevis ; the second enveloped in a complete fibrous canal, the others separated by simple cellular sheets ; the twigs of the anterior branch of the obturator artery and of its collateral nerve ; 5th, the obturator externus muscle, the adductor magnus, the posterior branch of the obturator artery. nervous filaments and some divisions of the internal circumflex artery.

In the second, or the inguinal space properly called, in order to arrive below the ischium, we meet with, 1st, the skin, thin as in the preceding part, but more uneven, softer and more extensible ; 2d, the subcutaneous layer, lodging in its lamellæ the super-

ficial lymphatic glands, the inguinal twigs of the superficial epigastric artery, the superficial external pudic, the corresponding veins, the saphena interna and some nervous filaments; the adipose cells are less regularly disposed in it than internally; 3d, the superficial sheet of the aponeurosis, its great oval aperture, shut by another fibro-cellular plate, pierced with holes for the communication of the lymphatic glands with each other, an opening in which we see, when this plate is removed, the entrance of the saphena and other subcutaneous veins into the crural, a portion of the latter trunk, a small portion of the femoral artery, and the origin of the external pudic arteries; 4th, the crural canal, filled with lymphatic glands, some cellular tissue, and filaments of the genito-crural nerve; 5th, the deep sheet of the aponeurosis, split externally in order to envelope the crural vessels; 6th the pectinalis muscle, a cellular mass inferiorly, the psoas and iliacus united, the origin of the profunda and internal circumflex arteries, which have passed through the aponeurosis; the crural nerve; 7th, the bursa mucosa which separates the psoas muscle from the pubis and from the fibrous capsule, the articular capsule, the head of the femur and the interior of the articulation, the *supra-trochantineal* gorge and the trochanter minor; 8th, the adductor magnus.

In the third situation we must traverse, in order to reach the bone, 1st, the skin, much thicker and of a more compact texture than in the preceding points; 2d, the subcutaneous layer, having nearly the same characters as internally, enclosing filaments of the inguino-cutaneous nerve and some of those of the crural, but no important vessels; 3d, the aponeurosis, single between the tensor fasciæ latæ muscle and the sartorius, double in order to form a sheath for the latter, and also very strong; 4th, the rectus femoris muscle, separated from the preceding fascia by the external circumflex vessels, some cellular tissue, and branches of the crural nerve; 5th, the origin of the three portions of the triceps extensor muscle, and the vessels which enter into it; 6th, the femur, which here presents to us its anterior ridge, running from one trochanter to the other, the fore part of its neck, enveloped by a prolongation of the capsule; the trochanter major, the termination of the glutæus minimus muscle, the notch which separates this part from the acetabulum; 7th and lastly, posteriorly the muscles of the glutæal region.

ART. II. OF THE THIGH.

This part of the limb is bounded superiorly by the inguinal region before and by the ischiatic region behind; inferiorly, by a circular line, which we will place at four fingers breadth above the condyles of the os femoris. It is slightly flattened upon its anterior and internal, posterior and external surfaces, when the limb is in the semi-flexed position; so that the axis of its greatest thickness would be oblique from before backwards and from without inwards. When extended, on the contrary, it is rounded and conoidal: whence it follows that in order to apply a roller bandage, for example, smoothly around the thigh, we are obliged to reflect it at every turn. It is in females, especially, that this conical form is very evident; in the adult man the thigh is more or less protuberant forwards and outwards; in strong muscular men we observe upon it a series of eminences and depressions which correspond to the muscles and their intervals, but these entirely disappear in women. We will divide the thigh into anterior and posterior regions, separated from each other by two lines, one of which is dropped from the trochanter major, the other from the ischio-pubic ramus upon the extremities of the transverse diameter of the circle which circumscribes them below.

Sec. I. Anterior Femoral Region.

This region is generally convex, but its surface presents nothing remarkable, except a species of superficial gutter which traverses it very obliquely from above downwards and from without inwards; a gutter, moreover, which seems to be a continuation of the inguinal hollow, and the direction of which is nearly parallel to that of the artery.

CONSTITUENT PARTS.

I. *The Skin.*

In its external and anterior half this membrane is thick, of a compact texture and but slightly extensible, covered with hairs in man, and filled with sebaceous follicles; in its internal half it is fine, soft, and possesses all the characters of that of the groin; so that, in the first direction, furuncular inflammations are more frequent than in the second, in which erysipelas is most easily developed, and abscesses and tumours project less readily outwards than inwards. Besides, as it possesses considerable mobility and is more vascular in the latter direction, it easily admits of an immediate re-union of its solutions of continuity, either by means of adhesive strips or bandages; as this membrane, however, is drawn upon by the contractions of the muscles, rest is indispensable in order that this re-union may take place without interruption.

II. *The Subcutaneous Layer.*

This is more regularly lamellated than in the groin, but is otherwise disposed in the same manner; filaments of the crural nerve, as well as venous and arterial twigs run through it in great numbers; it is also traversed by the great saphena vein, and is connected to the skin by processes more or less strong and numerous which fix it, on the other part, to the aponeurosis; processes which must be divided in order to raise the integuments, when we perform the circular amputation of the thigh according to the method of J. L. Petit, and which form different partitions in the phlegmonous abscesses so frequently occurring in this region. In relation to these abscesses, to erysipelas, etc., the observations which were made when describing the subcutaneous layer of the arm, are equally applicable here.

III. *The Aponeurosis.*

This is very strong, especially superiorly and externally, where it is nearly a line in thickness ; from which circumstance, in deep-seated inflammations, the parts which have a tendency to swell are, as it were, strangulated by this fascia ; and hence the violent pains which then sometimes manifest themselves. Commencing with it externally, it passes over the vastus externus, to which it is applied, to the rectus, where it sends off a thin lamina which slides between this muscle and the cruralis. It is on the outer side of the sartorius, especially, that it splits, so as to form a complete canal for this muscle ; which canal is continuous without interruption as far as the anterior and superior iliac spine, and communicates with the crural canal beneath the femoral orifice of this latter, and of which the anterior sheet is actually the continuation of the superficial layer of the fascia lata observed in the groin. Thus, this lamina after having passed before the sartorius muscle again unites to the deep seated sheet at the anterior margin of the gracilis, where they soon unfold anew in order to form another sheath for the latter muscle. The deep seated sheet increases in thickness in proportion as it dives into the femoral gutter. Here its laminae separate in order to envelope the crural vessels and two nervous branches ; so that, in order to come at the artery, it will be necessary, the sartorius muscle being reflected, to divide an additional aponeurotic lamina, a lamina which only differs from that which was pointed out in the inguinal region, but inasmuch as it possesses greater thickness. On the inner side of the vessels this deep layer of the aponeurosis rises over the adductor muscles, and reunites with the superficial layer. It follows from this disposition that, if we endeavour to expose the femoral artery about the middle of the thigh, we must not expect, if we cut a little distance from the sartorius, to find the aponeurosis bifoliated, as would be the case if the incision was made upon this muscle, or very near its margins ; and it is of essential importance to attend to this remark, if we wish to perform with certainty the operation under consideration. Finally, the fascia lata is so immediately applied upon the muscles, that, in deep and

narrow wounds, a kind of muscular hernia may protrude through the opening made in this aponeurosis.

IV. *The Muscles.*

The most important of all is the *Sartorius*, on account of its relations with the vessels. Let us remark in the first place that, enveloped in its fibrous canal, it may contract and move independently of the others; next, as it forms a curve, in passing through this region, which presents a gentle concavity forwards and outwards, it follows that, superiorly, the artery is nearer its internal margin than the external, whilst inferiorly, the reverse is observed; but, in all cases, we must seek for the vessel along one of its borders. Surgeons differ only with respect to that which it is most proper to prefer. Be this as it may, we ought to recollect the exact direction of its fibres, which are, as we know, parallel to each other and to the course of the muscle itself, for which reason incisions made parallel to the limb are also parallel to the sartorius muscle at the lower part of the thigh. The extent of its movements being commensurate with the length of its muscular fibres, we conceive that if the sartorius was cut completely across, its retraction would be considerable, and the more so because the aponeurosis which envelopes it gives it full liberty in this respect. Further, it is so close to the vessels that its transverse section, resulting from a wound, would almost necessarily involve the artery.

(*b*) The *rectus femoris* here presents almost the whole of its muscular portion; as it is also ensheathed by the fascia lata, but less completely than the sartorius, it is consequently free, and may contract without the participation of the triceps (extensor). Being the most superficial of the muscles of the anterior part of the thigh, it follows that its transverse section is not a very rare accident, and we conceive that such a wound must greatly interfere with the extending of the leg, although, if the two divided extremities are kept as closely approximated as possible, it will almost entirely recover its functions after the cicatrization.

We should also notice the obliquity of its fibres, a double obliquity, since it is penniforme: whence it follows that its internal

oblique fibres tend to cross those of the sartorius at an acute angle, and that this difference in the direction of the fleshy fibres may be of great service in the ligature of the femoral artery, as we will point out directly.

(c) The *Triceps* (extensor cruris) is disposed in such a manner that its external portion (the vastus externus) is very bulky, superiorly ; which, joined to the convexity of the femur forwards and outwards, determines the natural prominence which the thigh presents in this direction ; its internal portion (vastus internus), on the contrary, having its largest volume below, thus increases the concavity of the middle and superior part of the limb internally. It is this last portion which, by uniting with the tendinous portion of the adductors, forms the bottom of the gutter upon which the femoral vessels rest. The crural bundle (cruræus), concealed by the rectus femoris muscle, completely envelopes the fore part of the femur, as the vasti internus and externus do its sides. The triceps muscle, in thus attaching itself to the whole length of the os femoris, thereby becomes one of the principal means which nature opposes to the displacement of the fragments when this bone is fractured about the middle of its length. The fibres of the vastus internus are fasciculated and run obliquely from above downwards, from behind forwards, and from within outwards, approximating more and more to the transverse direction in proportion to their descent ; so that, if we reflect upon it ever so little, it will be impossible to confound them with those of the sartorius.

(d) The *Gracilis* continues to make a part of the internal border of the thigh ; enclosed in its canal, it otherwise presents nothing surgical.

(e) A portion of the three adductors forms the internal mass of this region : the middle (longus) at first conceals the greater part of the two others ; but as they descend they all expand, in order to be inserted into the linea aspera between the vastus internus and the short head of the biceps ; in expanding, they give rise to a very strong aponeurosis, which is principally observed upon their anterior aspect, and is continuous with the deep sheet of the canal which envelopes the sartorius muscle. It is this lamina which is called the aponeurosis of the adductor magnus, although it is rather an appendage to the adductor longus. In con-

sequence of their insertion into the posterior part of the femur. when they act alone, they turn the point of the foot outwards at the same time that they tend to approximate the two thighs. As all their fibres are directed obliquely outwards, it would be easy to distinguish them, if by chance we had fallen too much on the inner side of the sartorius, when seeking for the crural artery. Finally, it is well to note that the adductor magnus gradually detaches a tendon from its internal border, which is prolonged to the internal femoral condyle; so that we will see it again in the region of the knee.

v. *The Arteries.*

(a) The *Femoral*, following the direction indicated when studying the groin, gradually approximates the internal border of the thigh until it reaches the junction of the middle third of this member with its inferior third, when it passes behind and takes the name of *popliteal*. An abstraction being made of its immediate aponeurotic sheath, the femoral artery is lodged in a canal formed, externally, by the vastus internus, near its attachments to the os femoris; internally, by the tendinous part of the adductor muscles, and posteriorly by the union of the latter with the triceps cruralis, near the linea aspera; finally, anteriorly, by the sartorius, but in such a manner that, although this vessel still remains free on the inner side of the internal margin of this muscle, for the extent of one or two inches superiorly, yet as it descends, the sartorius gradually advances over it, so that before the artery perforates the adductors it is situated almost exactly under the middle of its anterior surface, whence it follows that, in order to apply a ligature around this vessel at the point selected by Mr. Hunter, we are equally obliged to reflect the sartorius, whether we make the incision along its external margin, as recommended by MM. Boyer, Roux and Hutchinson; or on the contrary, on its internal margin, as preferred by M. Lisfranc;* or lastly, directly upon its anterior surface, as advised by Hodgson and many others. Of these three methods it is evident that the last is most objectionable. Of the two others, that of M. Roux seems to be the most easy and most certain, because after

* Taxil thèse, 1822.

the integuments and aponeurosis which cover the sartorius have been divided, it is sufficient to push this muscle inwards, in order that we may readily distinguish the artery enveloped by its sheath in the bottom of the wound. It is in this case, especially, that it is important to recollect the direction of the fleshy fibres, because, in fact, if the incision had been commenced too far outwards, or the edge of the bistoury too much inclined in this direction, we would divide the fascia lata previous to its unfolding, and fall upon the rectus femoris muscle or the vastus internus. Then, if the surgeon does not immediately perceive it, he will dig in vain among the muscular fibres even down to the femur; he would not find the artery. We have frequently seen students, when teaching them the operations upon the dead body, fall into this error. That of M. Lisfranc has the advantage of producing a wound which more readily permits the escape of the secretions; we also avoid by it the mistake relative to the muscles; and, the saphena vein, the wounding of which is so much dreaded by Mr. Hutchinson, even by the method of Scarpa, in the upper part of the thigh, may always be easily avoided, if we use ever so little caution. But, we might open the fibrous sheath of the gracilis muscle, instead of that of the sartorius, if the instrument is directed too much inwards, or if its edge is not sufficiently inclined outwards; and, as these two muscles have nearly the same direction, it would be more difficult to detect the error; we might also deviate among the adductors, which we would recognize, however, by their oblique course outwards and downwards. On the other hand, we must admit that the artery is generally a little nearer the external margin of the sartorius than the internal. Finally, let us remark that, by all these methods indiscriminately, the reflection of this muscle, in one direction or in the other, is not always so easy a matter upon the living man as we would imagine, and that its transverse division, as proposed by Desault, in difficult cases, may occasion the loss of its action; for if it is indeed true, as M. Ribes affirms, that, after the cure, the fibrous cicatrix of the muscles adds to, rather than diminishes their power, yet here the cicatrix is formed not only at the expense of the divided muscular extremities but also of the fibrous canal which surrounds them; so that, at least, there will result an adhesion which will interfere, more or less, with the extent of

its movements. But, why incur all these difficulties? Is it not now proved that the circulation will be re-established equally as well when the operation is performed in the superior half of the thigh? And how great is the difference then in the simplicity of the operation! No possible error here; the artery is superficial; we feel it pulsate through the skin; we reach it with certainty by cautiously dividing, layer after layer, the skin, the fascia superficialis, and the anterior sheet of the fascia lata; there, on the contrary, to what depth must we not penetrate?

Such are the mediate relations of the femoral artery. Let us now examine it in the canal which is formed for it by the deep sheet of the aponeurosis; a canal, which does not differ in the least from what it was in the groin, even as far as the middle of the thigh, but which is very remarkable a little lower down. In fact, its anterior paries, that is to say, that which separates the artery from the sartorius muscle, becomes extremely thick as it descends, because it is strengthened by laminae which are detached from the fore part of the tendinous portion of the adductors, in order to reach the internal aspect of the triceps cruralis, near its attachment to the femur. Consequently, in entering the popliteal space the artery does not pass through a simple fibrous ring, but a complete canal, which is prolonged upwards even to the iliac spine, and which has only become stronger and much more complete where this trunk passes obliquely through the flattened tendon of the last two adductor muscles. Be that as it may, we consider that this mechanism secures the artery from all compression during the action of the muscles. This canal also includes the vein, and sometimes two nervous branches, or, at least, the internal saphenus nerve, and some cellular tissue which forms a layer for each of these organs, and, besides, a general envelope for the whole. The artery is always upon a more anterior plane, but in such a manner, that superiorly it is situated on the outer side of the vein, and that the latter gradually becomes almost entirely posterior, and not external, before it enters into the popliteal space: whence it follows that, in order to tie the former, we should always seize it at its inner side, at whatsoever point we perform the operation. With respect to the nerve, it is most frequently anterior and external, and sometimes also upon the interstice which separates the two vessels; when there

are two, one of them usually occupies the latter, the other the former situation: besides, they are usually so large that they may be easily distinguished and avoided.*

We may also remark that the opening through which the vessels pass into the popliteal region, being situated at five inches above the internal condyle of the femur, it is important that the incision for the ligature of the artery should not be made too low, and that it should be prolonged at least as much upon the middle third of the thigh as upon its inferior third. Finally, it should be noted that, if it is more proper to divide with the bistoury than lacerate with the director the aponeurotic sheath in the inguinal region, much more ought we to act in the same manner when we operate low down in the thigh, where this sheath is much stronger and thicker; however, if we were apprehensive of wounding the artery, in making this division, it would be sufficient to make a slight incision a line or two on the outer side of the vessel, because it would afterwards be easy to introduce thereby a grooved director, upon which we might dilate the opening without fear.

(*b*) The *Arteria Profunda femoris* (*deep femoral*) terminates in the crural region by giving off the last two perforantes and sometimes the first; but these branches afford but very little interest in surgery: let us remark, merely, that one of them passes between the pectinalis and adductor brevis muscles, or indeed through the tendon of the latter, in order to arrive at the posterior region, and that the two others enter into it by traversing the adductores longus and magnus; so that we must seek for them in this direction, when we wish to secure them after amputations.

(*c*) The *Anastomoticus Magnus* is a branch forgotten in our classical treatises, and which the femoral trunk furnishes previous to its passage through the adductor magnus. As it sometimes originates two or three inches higher, and as its volume in certain subjects

* Lest any person should consider these details of relations as superfluous, we would inform them that quite recently, the 12th July, 1823, a man named Pierre was operated upon at the Hotel-Dieu of Caen for an aneurism of the popliteal artery, after the method of Hunter, by one of the most dexterous surgeons of that town, and that the ligature was placed upon a bundle of cellular tissue which had been mistaken for the artery: the error was not detected until the examination of the body.

is so considerable as to form a very large arch, by uniting itself with the inferior internal articular, we conceive that it would be advantageous, in these cases, to place the ligature below rather than above its origin, whenever the disease permits us to select the place of operation. This artery is perhaps the only circumstance which we can bring in favour of Hunter's method. After its origin, it runs obliquely inwards through the adductors, in order to descend parallel to the direction of the tendon of the magnus, and we will again find it in the ham. It requires a ligature after the amputation of the thigh in the place of election, more frequently than the perforantes and the superficial muscular which creeps between the rectus and cruræus muscles.

VI. *The Veins.*

(a) The *Saphena Interna* (magna) or, *the superficial branches* enveloped by the deep plates of the subcutaneous layer, take a serpentine course upon the internal third of the region, running obliquely from within outwards towards the fold of the groin: so that they may sometimes embarrass the surgeon, when he is obliged to make incisions which tend to fall on the inner side of the femoral artery; it is also with the view of avoiding this vein, that Hutchinson prefers seeking the principal arterial trunk of the thigh, by cutting upon the outer side of the sartorius muscle. As the saphena is not surrounded by any nerve in the region under consideration, it would seem that, in cases in which we think it necessary to treat varices of the leg by the ligature, the operation ought to be less dangerous above than below the knee.

(b) The *Femoral vein*, very large, possessing but few valves, yet very seldom affected with varicose dilatation, is included in the same fibrous sheath with the artery, and partakes of the same general relations, relations which were pointed out when speaking of the latter vessel and which seldom present anomalies. We have, however, recently observed (Nov. 15th, 1825,) a very remarkable anomaly, in a subject dissected by MM. Bronson and Cromwell, in the *pavillons* of the *école pratique*. In this subject the two vessels took their usual course as far as to five fingers breadth below Poupert's ligament; but, afterwards, the vein deviated from the artery in such a manner, as to pass obliquely through

the fleshy portion of the adductor longus muscle about two inches lower down, in order to enter into the posterior region of the thigh; when it had reached the popliteal space, this vein resumed its usual situation, and the limb of the subject, otherwise, presented nothing remarkable. It is evident that a similar anomaly would be very advantageous, if it existed in a case requiring the ligature of the femoral artery; but, we ought also to note that a wound upon the internal third of the limb would easily occasion a very profuse venous hæmorrhage.

VII. *The Lymphatics.*

This system presents nothing remarkable in this region; the superficial and deep-seated lymphatics pass into the corresponding inguinal glands, which, for that reason, become swollen, engorged and very rapidly inflamed when the fore part of the thigh is affected with inflammatory diseases.

VIII. *The Nerves.*

They are all derived from the crural nerve, and are the same which were pointed out in the groin. A great number of filaments have perforated the fascia lata, in order to ramify in the subcutaneous layer and terminate in the skin; the other filaments are distributed to the muscles. Those two nerves which accompany the femoral artery are the only branches which merit attention. Their relations with this vessel are the same as in the upper part of the thigh, until the moment the artery begins to enter the oblique canal formed for it by the tendons of the adductor muscles; then the femoral nerve, properly so called, rises a little upon the internal surface of the triceps extensor and continues to descend towards the knee, whilst the saphenus does not abandon the arterial trunk until the instant when the latter has completely entered into the popliteal space; but at length it removes from it, or rather it ceases to follow the same direction, and then passes, first, between the adductor magnus and sartorius, afterwards between the latter muscle and the gracilis, before it becomes superficial: so that it would be easy to comprise it in the ligature applied

around the the femoral artery, in whatever portion of the thigh this operation might be performed, and as it distributes itself even to the great toe, we conceive that it is important to exclude it.

IX. *The Skeleton.*

It comprises the entire body of the femur ; but as we will be obliged to speak of this bone relatively to its fractures, when we study the posterior femoral region, we will say nothing of it here.

Sect. 2. Posterior Femoral Region.

We are obliged to prolong it a little more towards the pelvis than the preceding, on account of the fold of the buttock or the sub-ischiatic groove ; its surface is, in general, regularly rounded, unless it is inferiorly, where it presents the origin of several prominences and depressions which are found in the popliteal region.

CONSTITUENT PARTS.

I. *The Skin.*

Its characters are nearly the same as in the preceding region ; it is not, however, quite so delicate as the internal, nor so strong and dense as the external part of that which we have just studied ; but, it is generally more extensible, and permits tumours which are developed beneath it to acquire an enormous magnitude, without necessarily becoming disorganized. In man, it is covered with a great number of hairs, and contains many follicles ; as it is besides very vascular and soft, it is therefore more disposed to erysipelas and other inflammations than the integuments of the external part of the thigh.

II. *The Subcutaneous Layer.*

It is in general very thick, filamentous and lamellated, of a pretty lax texture, and encloses a great quantity of adipose cells:

consequently it is easy to dissect and separate from the aponeurosis, except, however, in the groove which corresponds to the point of union of the vastus externus with the biceps; at this place, in fact, its lamellæ are more approximated and condensed, so that it assumes the fibrous character, and its adhesion to the fascia lata is so firm as to merit some attention when we attempt to raise the skin in amputations. As it is continuous, without line of demarkation, with the adipose layer of the haunch, as well as with that of the anterior crural region, and is besides more supple and thicker than anteriorly, it follows that infiltrations, purulent collections, etc., rapidly form in it, that fluids easily extend into it from other points, and that phlegmonous and erysipelatous inflammations produce in it great devastation; but, although rich in sanguineous capillaries, as it does not lodge any large artery or important nerve, we may, if necessary, make deep and numerous incisions into it, for the purpose of evacuating fluids, without danger.

III. *The Aponeurosis.*

Commencing at the external part of the region, that is to say at the place where it descends from the vastus externus upon the linea aspera, the fascia lata unfolds when it reaches the outer portion of the biceps, semi-tendinosus and semi-membranosus muscles, so that one of its sheets passes behind these fleshy bundles, whilst the other spreads over their anterior surface, between them and the adductors; near the posterior margin of the gracilis, these two laminae reunited separate anew, in order to form a sheath for this muscle, as was mentioned in the anterior region. In consequence of this arrangement the three muscular masses which are attached to the tuberosity of the ischium are enveloped in a fibrous canal, which divides inferiorly, where these organs separate in order to circumscribe the popliteal space, into two distinct sheaths, one, external, for the biceps muscle, the other internal, for the semi-tendinosus and semi-membranosus. It is evident then, from this disposition of the fascia lata, that three species of abscesses may manifest themselves at the posterior part of thigh; thus, 1st, the pus may collect in the fascia superficialis between the aponeurosis and the skin; 2nd, it may accu-

mulate in the sheath of the biceps, etc., muscles; 3d, the collection may form before this sheath, between its anterior sheet and the attachment of the adductors to the linea aspera.

IV. *The Muscles.*

(a) The *biceps* is the principal: at first concealed by the *glutæus maximus* upon the ischion, it is soon enveloped with the *semi-tendinosus*, etc., in the fibrous sheath of which we have just spoken; near its origin, it is at least an inch distant from the femur and adductor magnus, but gradually approximates these parts as it descends, at the same time inclining slightly outwards; so that it receives upon its anterior margin the fibres of its short portion as it is entering into the popliteal space, of which it forms the external border. When the leg is flexed, we perceive, between the biceps and vastus externus muscles, a groove, which increases in depth as it descends, and which we might name *external femoro-popliteal*: it is in the bottom of this groove that the subcutaneous layer is most adherent. Finally, we see that, by the superior extremity of its long portion, the biceps is very well disposed in order to act with energy upon the ischion, and consequently upon the whole of the pelvis: so that it is one of the most powerful extensors and one of the firmest supporters in the vertical station.

(b) The *semi-membranosus* and *semi-tendinosus* originate from the same point with the biceps, descend also in the same fibrous sheath, the one before the other: they separate from it in passing slightly inwards, so as to leave between them the origin of an excavation which may be called *median femoro-popliteal groove*. During the flexion of the limb, these two muscles form below an extremely prominent cord, and which is principally produced by the *semi-tendinosus*; this is the internal border of the ham, (*inner ham-string*;) a border separated from the *gracilis* muscle by another groove much less distinct, and which we will also find again in the popliteal region. Furthermore, they, as well as the biceps, are removed from the adductor magnus by a space, a species of canal, circumscribed posteriorly by the anterior sheet of the sheath for the muscles just mentioned; anteriorly, by the posterior aspect of the adductor magnus; internally and

externally, by the internal surface of the aponeurosis, as it is passing upon the limits of the region; this canal which becomes flattened and contracted by degrees as it descends towards the popliteal space, is prolonged upwards, where its dimensions are greater, in order to become continuous with the *ischio-trochanteral notch*; so that, by this relation, it derives its origin in the pelvis through the medium of the great ischiatic notch. Now, as it is filled with a very supple and very lax lamellated cellular tissue, it follows that phlegmonous inflammations readily take place in it; that the pus formed in its superior portion tends continually to pass below, and does in fact often pass there; that fluids may enter into it from the cavity of the pelvis, first, by the cellular interstice which exists between the superior border of the adductor magnus and quadratus femoris muscle, if the deposition had previously been made in the sub-obturatrix fossa; afterwards, by the great ischiatic notch. We have not had an opportunity of ascertaining, upon the dead body, whether this last method of the formation of abscesses by congestion ever does occur, but the cellular train of which we have just spoken proves the possibility of it, and we have observed a young man in whom it is extremely probable, if not certain, that this state of things existed. This subject, 18 years of age, was admitted into the hospital of *la Faculté*, the 20th of June 1824: In the superior and posterior part of his left thigh there was an oblong tumour as large as a child's head; fluctuation was evident, and the skin was not attenuated. The commencement of this tumour was dated at four months; it had slowly developed itself, and was without pain. The patient did not know the cause of it; only he had kept his bed two months on account of a fever which was called an inflammation of the belly. When this abscess was opened several quarts of pus were discharged, and it was satisfactorily ascertained that the femur and ischium were sound. After two months the suppuration, having gradually diminished, ceased, and the cachetic state and paleness had almost entirely disappeared; but a fistulous ulcer remained, through which a probe could be passed as far as the upper and outer part of the ischium, before the glutæus maximus. Since leaving the hospital, this young man has repeatedly returned for public consultation: we have several times attempted to consolidate the walls of this ulcer by

means of adhesive bandages together with compression ; and, in two attempts, the parts have become inflamed and a new abscess has been the consequence. May we not infer then that the seat of this disease is in the abdomen, and that the fluids escape from the pelvis by the great ischiatic notch ?

v. *The Arteries.*

These are only some inconsiderable branches of the arteries of the glutæal, inguinal and anterior femoral regions. Thus superiorly, the ischiatic artery sends off a branch of a certain volume which turns under the ischium, in order to reach the perineal region ; then it gives off another which seems to be the continuation of the trunk, and which descends between the two muscular layers, even to the popliteal space ; the latter generally requires a ligature after the amputation of the thigh : and as it runs in a very lax cellular tissue it retracts considerably, so that it is not always easy to find it after its division. More deeply and internally, we find some branches of the internal circumflex, which have traversed the adductor magnus, but which are of no interest in surgery ; so with respect to some twigs from the obturator : next come the perforantes, derived from the profunda, all of which enter the cellular space which exists between the posterior surface of the adductor magnus and the other muscles, in order to be distributed to the latter. As these branches anastomose with each other, with the obturator or the circumflex, they form a circuitous route, which nature makes use of advantageously when the trunk of the femoral is obliterated below and even above the origin of the profunda. In amputations we are frequently obliged to tie one or several of these vessels, although their calibre renders them incapable of furnishing a very abundant hæmorrhage, unless by anomaly.

vi. *The Veins.*

Sometimes we find a portion of the posterior branch of the saphena in this region of the thigh ; the other subcutaneous veins have no positive distribution ; these small vessels frequently occasion upon the skin those variegated streaks (*marbrures ou ver-*

gures) which we observe, especially upon the fore part of this limb, in women who habituate themselves to the use of foot-stoves, etc. As to the deep-seated veins, they are adherent to the arterial tunics, and merit still less attention than the superficial.

VII. *The Lymphatics.*

Those of the superficial order gradually turn over the inner margin of the thigh, and enter into the anterior femoral region. The greater portion of the deep-seated also enter into this region, by passing with the arteries through the muscles; but some of them ascend to the ischiatic notch, where they penetrate into the pelvis: whence it follows that diseases of the skin and of the sub-cutaneous cellular layer, in the posterior femoral region, may determine an engorgement of the superficial inguinal glands, and that inter-muscular disorganizations, in reacting upon the deep-seated glands of the groin, may also occasion the tumefaction of some of those of the pelvis.

VIII. *The Nerves.*

Although the small sciatic and obturator nerves distribute branches to this region, which follow nearly the same direction as the arteries of the same name; although we sometimes meet within it some filaments of the anterior crural nerve also, the great sciatic is the only one which should particularly engage the attention of the surgeon. This cord is, as every one knows, the largest of all the nerves in the body; formed of a great number of filaments applied upon each other, enveloped in the same sheath with the muscles which originate from the ischium, it usually descends to the place where the biceps and semi-membranosus diverge in order to form the ham-strings, without bifurcating; so that, in order to reach it in the middle of the thigh, we would have to divide the integuments, the sub-cutaneous layer, a sheet of the aponeurosis, and separate the biceps, semi-tendinosus and semi-membranosus muscles. Its position is such, that it may readily be compressed by sitting upon an uneven seat, or on the edge of a chair: hence it often happens that, when we remain

thus seated for a few moments, we feel a general torpor throughout the limb; as it sends off no considerable branch when passing through this region, it thence follows that it is the nerves first mentioned which here preside over the sensibility, and that the violent pains sometimes experienced at the posterior part of the thigh ought not to be referred to the great sciatic nerve, when they do not at the same time extend below the knee. It always encloses an artery, which is sometimes large enough to require a ligature after amputation; an artery, moreover, which likewise gives ramuscles to the nervous filaments, or rather to the neurilemma which envelopes them: so that this large cord is more exposed than any other to inflammation, as well as to all the other pathological changes of which the nerves in general are susceptible. Therefore neuralgia is most frequent and most dangerous in the inferior extremity.*

IX. *The Skeleton.*

It comprises the body of the femur only. As this bone is enveloped by numerous and bulky muscles, it is thereby protected against fractures from direct causes; but its length, its curvature and its thickness, the last two of which diminish as we approximate its middle part, dispose it, more than any other, to fractures by *contre-coup*. In fact, when a fall takes place upon the feet or the knees, the weight of the body, on the one part, and the resistance of the ground on the other, will tend to approximate its two extremities; so that this double movement rushing, if I may so say, towards the point at which this bone is most curved and most slender, it consequently follows that it will be apt to yield readily in this situation. From this disposition, also, the flexor muscles of the leg being sufficiently remote from the axis of the femur, to tend to increase its curvature, and those which lie upon its anterior surface tend to make it disappear with so much energy, by their sudden and violent contractions, that by reflecting upon it a little, fractures by simple muscular contraction are actually less difficult to comprehend than certain persons are willing to admit of. Besides, if the humerus can be broken in this way, an example of which may be found in the

* For local affections of the nerves see the work of M. Descot.

Medical Repository, vol. i., three others related by MM. Ferrière, Odienne, and Willaume, and that of a patient which came under our own observation, whose case has been published by M. Haime of Tours, we do not see why the femur is not susceptible of the same accident; and if the fact recorded by M. Willaume in the *Journal Universel des Sciences Médicales*, tome ii. page 373, is not of a nature to produce general conviction, it at least renders the possibility of this accident very probable. According to the muscular arrangement, fractures of the body of the femur may be referred to two species, relatively to the displacement which must follow: in fact they may either take place in the superior half, but below the trochanter minor; or in the inferior half, yet above the popliteal region. In the first case, the action of the pectinalis, psoas and iliacus muscles will predominate, and the superior fragment will almost uniformly pass before the other; in the second, on the contrary, the glutæus maximus, on the one hand, the adductors brevis and longus, on the other, will prevail so much over the preceding muscles, as to draw this same fragment backwards, whilst the inferior, drawn in the same direction by the adductor magnus, semi-tendinosus, semi-membranosus and biceps, but in such a manner as to make it tilt forwards (*basculer*), will be pulled upon by the triceps and rectus, which will tend to make its superior extremity ride before the coxal end of the broken bone.

Furthermore, if we can easily comprehend the reason of the considerable overlapping which is sometimes observed in all these fractures, on account of the length, number and power of the muscles which pass from the pelvis to the leg without being attached to the thigh, we may also without difficulty conceive how it is that, in some other cases, there is scarcely any displacement, by paying attention to the still greater force of the triceps extensor and adductors, as well as to the manner in which these muscles are attached to the femur.

The curvature of this bone should be particularly attended to when it becomes necessary to apply upon the thigh a fracture apparatus: and it is perhaps one of the greatest obstacles to consolidation exempt from deformity. In fact, should we succeed in removing the overlapping by the assistance of Desault's long splint, that of M. Boyer, or by any other means of extension

which are applied at the same time upon the foot and against the pelvis ; as the tractions are then made upon the femur in the direction of a straight line, it follows that, after the cure, its curvature is more or less diminished. Should we simply make use of Scultet's bandage, with splints pressed very firmly against the internal, external and anterior aspects of the limb, the same effect will be produced, the bone will be more or less straightened, and the two corresponding extremities of the fracture will even project backwards : so that, with respect to the solution of continuity of the body of the femur, with or without displacement, the relaxation of the muscles, which we obtain by placing the limb upon a double inclined plane, as has long been the usage at Hotel-Dieu, combined with the application of the bandage of slips, in order to prevent the disturbance of the fragments by the spasmodic contractions, which otherwise would occur during sleep, is the most rational means that can be employed.

As in the numerous methods which have been proposed for amputating the thigh, the chief object of surgeons is to prevent the projection of the bone, we will perhaps be excused for a brief reconsideration of this subject. Thus, whatsoever plan we may adopt, we will never prevent the retraction of the rectus, sartorius, gracilis, long portion of the biceps, the semi-tendinosus and semi-membranosus muscles, which are enveloped in as many fibrous sheaths : as they all derive their fixed point from the pelvis, they will retract the more towards this attachment the nearer the amputation is made to the knee ; because, if the strength of a muscle is proportionate to the number of its fibres, the extent of its actions must be estimated by their length ; consequently, the lower we amputate the thigh, the greater must be the distance of the incision of the integuments from the place where we intend to saw through the bone.

As, on the contrary, the triceps and adductors are, if I may so say, incorporated with the bone, they can, in no case, retract very far ; but, as it is also very difficult to draw them over the part divided by the saw, it so happens that, when they alone are to contribute to the immediate reunion, the end of the femur becomes denuded, and soon after necrosed ; so that, in order to obtain the most advantageous result, we must not only cut the superficial muscular layer very low, but we must also favour as

much as possible its immediate retraction, in order that we may divide very high the fleshy fibres of the deep layer. What is the method then by which we can best obtain this result? It is evident that by raising the skin, according to the principles of J. L. Petit and Cheselden, that we will not completely succeed, unless we divide the muscles at two different incisions, as advised by Louis. It is also certain that the method of Alanson, which consists in cutting the soft parts with a single stroke, taking care to incline the edge of the knife more or less towards the point of the bone upon which the saw is to be applied, with the intention of making a hollow cone having an inferior base, is still more defective, since this surgeon restricted himself to drawing back the skin, the retraction of which he likewise favoured by dividing the bridles which hold this membrane to the aponeurosis, but without dissecting it. The modification to this operation introduced by Professor Dupuytren renders it more suitable for accomplishing the end in view. This dexterous surgeon, by causing the muscles to be forcibly drawn up in proportion as they are divided, reserves the important resource of cutting, with the second stroke of the knife, those which are adherent to the bone very high up; so that this process is very similar to that of Louis, except that a little more skin is preserved and that the operation is much more expeditious. In fine, it seems to us that the best method of amputating the thigh, so far as concerns the section of the soft parts and of the femur itself, will consist in dividing the skin as proposed by Alanson, and the muscles according to Louis or M. Dupuytren, in order to saw through the bone in the usual manner. By this procedure, the skin still retaining its union with the fascia lata, will incur no risk of mortification or suppuration, and the immediate reunion will always be possible. We cannot perceive what would then oppose the exact approximation of the two lips of the wound, on placing all similar tissues in contact with each other. Neither do we see what additional advantages can be derived from the flap operation, as proposed by Vermale and Ravaton, since the principal object of these surgeons was to prevent the projection of the bone, and, of their modern imitators, to obtain adhesive union without suppuration. Now, if this last condition is possible by the latter method, it must most assuredly be so by that which we have just described. Nevertheless, several

celebrated surgeons have quite recently boasted of the flap operation of the thigh, and Symes,* Liston,† Hey‡ and Guthrie|| in England, and Klein§ in Germany, seem to give it the preference over the circular method.

Let us remark further, in favour of immediate reunion by one method or by another, in case we should wish to defend them, that the consecutive retraction of the muscles will be so much the greater in proportion to the profuseness of the suppuration and the tardiness of the cicatrization. In fact, the prolonged irritation of the stump, and the emaciation almost always attendant upon the union by the second intention, occasion the superficial muscles to diminish in bulk and to retract to a much greater distance within their sheaths, than when the adhesive union is affected promptly and without suppuration.

At the moment the diseased part is separated from the sound portion of the limb, if we take the bone for the centre, we will find the following disposition of the organs : anteriorly, we meet with the middle portion of the triceps extensor and rectus femoris, separated by a cellular layer generally of but moderate thickness, and in which we usually find the muscular artery, which it is necessary to tie ; posteriorly we see the attachment of the adductors, a thick cellular layer, containing some branches of the arteriæ perforantes, the semi-tendinosus, semi-membranosus and biceps muscles, included in their aponeurotic sheaths, with the great sciatic nerve, and which frequently receive arteries also requiring a ligature : it is not uncommon to meet with one of considerable volume in the centre of the nerve ;¶ externally the vastus externus exists alone, and there are no arteries to secure ; internally we find, applied directly against the bone, the vastus internus, then the adductors ; between them the femoral artery and vein ; next, the sartorius and gracilis muscles, each enveloped in their

* Edin. Journal, vol. 14. † Idem. ‡ Practical Obs. &c. || On gun shot wounds. § Practische Ansichten, &c. Stutgart, 1816.

¶ The nerves being destitute of a retractile power it sometimes happens that, after amputation, they project beyond the level of the wound ; then it would be advisable to make a resection of them ; for, being irritated at each dressing, especially when immediate reunion has not taken place, they may be the cause of very serious symptoms ; and a great many examples have been collected by M. J. Desrot, in the work before cited, which render this assertion incontestible.

distinct sheaths. In the first direction, a single ligature will be necessary, unless the operation has been performed very high up, in which case we would also have to apply them in some subjects, upon the principal descending branches of the external circumflex. In the second we will generally have to tie some division of the perforantes near the bone, or in the muscular fascis; and, if it is in the superior third, the nutrient artery of the femur, the descending branch of the ischiatic, and sometimes one or more twigs from the internal circumflex. In the third, there is no particular one; but when the thigh has been amputated very low or very high, we may be obliged to secure one of the articular arteries or some others from the external circumflex. Finally, it is in the fourth that we must seek for the femoral artery, in contact with its accompanying vein and nerve. Towards this point we likewise find, superiorly, the profunda; inferiorly, the great anastomotic, and in the middle the trunk of the perforantes. All the secondary branches being more particularly distributed to the muscles most susceptible of retraction, and these vessels being retractile themselves, and having, besides, proportionately thicker tunics than the arteries of the first order, it is more easy to seize them with the tenaculum than the forceps. The femoral and the profunda, on the contrary, should always be laid hold of with the latter instrument, because they would be torn by the point of the other. In tying the trunk of the crural, it should be observed that, if we do not pay attention we may readily comprise in the loop of the ligature the nervous branches which surround it; and the femoral vein especially is so adherent to it that many celebrated surgeons have found it most convenient to introduce one blade of the forceps into the canal of the artery and the other into that of the vein, in order to embrace them in the same thread; but this is not unattended with danger, for the venous trunk, thus strangulated, will frequently inflame after the application of a ligature, and the inflammation of veins is, we well know, excessively dangerous; so that, every thing well considered, it is better to tie the artery alone.

As it respects the order of superposition, in the different points of the thigh, it is very simple, and we have just now almost pointed it out from the centre to the circumference. From the surface towards the bone, we find anteriorly, 1st, the skin; 2d, the

subcutaneous layer ; 3d, the aponeurosis, single externally, bifoliated internally, on account of the sartorius muscle and the vessels ; 4th, the rectus femoris, cruralis and sartorius ; 5th, and lastly, the femur.

Posteriorly, we meet with, 1st, the skin ; 2d, the cellular layer, more loaded with fat, and including some *veinules* and a few nerves ; 3d, the aponeurosis, thinner than anteriorly ; 4th, the muscular bundles which proceed from the ischium to the ham, and the great sciatic nerve ; 5th, a second aponeurotic expansion, still more attenuated than the former ; 6th, a cellular layer, thicker above than below ; 7th, the adductor magnus ; 8th, lastly, the bone of the thigh.

Externally, we only find, 1st, the skin ; 2d, the subcutaneous layer ; 3d, the aponeurosis, extremely thick and strong ; 4th, the vastus externus, and 5th, the os femoris.

Internally and lastly, we observe, 1st, the integuments ; 2d, the superficial layer enclosing the vena saphena and the branches which come to empty into it ; 3d, the fascia lata, thicker than posteriorly, thinner than anteriorly ; 4th, the gracilis ; 5th, another fibrous sheet ; 6th, the three adductors and some vascular branches ; 7th, the bone.

ART. III. OF THE KNEE.

The figure of the knee is very irregular and indeterminate : it is bounded superiorly, by the circular line which forms the inferior limit of the thigh, and is separated from the leg by another circular line placed at the distance of four fingers' breadth below the patella. The two sub-pubic and coxo-malleolar lines will divide it into anterior and posterior regions.

Sect. 1. Anterior Region, or Region of the Knee, properly so called.

Its surface presents, in the middle, a very striking projection, which is more prominent when the limb is semi-flexed than in complete extension and flexion : this eminence is triangular, having its apex turned downwards, and corresponds to the patella ; above this, the limb being extended and the muscles quiescent.

we find a transverse groove, upon which we apply one of the graduated compresses, for the purpose of retaining the two fragments in contact, in transverse fractures of the patella; below it, another notch, which corresponds to the fore part of the articulation, and upon which we place the other compress in the accidents just mentioned. When the muscles are thrown into action during semi-flexion, each of these notches is divided into two fossettes; one, by the tension of the ligamentum patellæ, the other by that of the tendon of the rectus femoris muscle; below the inferior we feel a fixed prominence, which is formed by the tubercle of the tibia, and is continuous with the spine of this bone. Upon the inner side of the patella we see a groove, which is parallel to the axis of the limb, and is continuous above and below with the internal fossettes of the two preceding notches. We may remark that if an instrument is introduced at one of these points, it will penetrate directly into the joint, or rather into the synovial membrane, and that there we most easily distinguish the fluctuation in *hydrops articuli*. More posteriorly, we observe the prominence produced by the internal condyle of the os femoris, which prominence may be divided into two others; an anterior, which bounds the preceding groove, and a posterior, which forms a part of the inner margin of the ham (*popliteal space*); below these two tuberosities we feel a narrow and transverse groove, which leads directly into the inter-articular line: then, a little lower down the internal condyle of the tibia, which is continuous with the internal border of this bone; superiorly, this internal prominence is prolonged by a species of cord, which we readily perceive when the limb is semi-flexed, and which corresponds to the tendon of the adductor magnus; anterior to this cord we observe the relief formed by the termination of the vastus internus muscle. On the outer side of the patella there is also a groove as on the inner side, which is only perceivable during extension; this groove is lost in the two external fossettes of the notches first indicated, and of which the superior corresponds to the interval which separates the tendinous termination of the vastus externus from that of the rectus femoris. A little more externally, we see the eminence formed by the external condyle, which is less than the internal; below it, a small transverse groove, which also points out the joint: then the external con-

dyle of the tibia, and finally, externally and lower down, the head of the fibula.

These features, which may readily be perceived at the first glance, cannot fail to find numerous applications in surgery, whether to determine the place where it is proper to introduce the knife in order to disarticulate the leg, or to penetrate into the joint, when it becomes necessary from disease: or when it is required to form our prognosis or diagnosis respecting wounds of this region, or lastly, to estimate its luxations or fractures. But in order that we may derive from them the most advantage, we should recollect that they are in a great measure obliterated by tumefaction and certain positions. Let us remark, by the way, that the external aspect of the body, thus considered by sections, is of much greater importance than has hitherto been supposed, and although in the opinion of some persons, M. Lisfranc seems to have carried this examination too far in some points, we are at least under great obligations to him for having called the attention to this subject, which every one may study upon himself.

CONSTITUENT PARTS.

I. *The Skin.*

Like that of the elbow, it is thick, rough, and more or less wrinkled upon the middle eminence, more delicate and supple internally; it also contains numerous sebaceous follicles, and supports some hairs superiorly, externally, and inferiorly; so that its folds, follicles and hairs dispose it to diverse pustular and herpetic eruptions.

II. *The Subcutaneous Layer.*

This layer in abandoning the eminences formed by the muscles of the thigh, gradually divests itself of its adipose vesicles; its lamellæ become approximated, condensed, and finally almost confounded with the aponeurosis; on the inner side, where it encloses some adipose vesicles and the internal saphena vein. it is thickest; externally, it forms but a very thin web; upon the fore part of the patella its laminæ constitute a pouch, a large

bursa mucosa, which not unfrequently becomes filled with a serous fluid, forming a rounded tumour which sometimes equals the volume of an egg. We have met with this tumour several times in labourers and hard-working farmers, and we must confess that most frequently it was filled with a sanguineous fluid instead of a pure and unctuous serosity. In such cases it is a complete cyst, which would seem susceptible of cure only by extirpation or the injection of an irritating fluid, capable of producing adhesion of its parietes; but M. Boyer has long since ascertained that the application of compresses wet with a strong solution of the hydro-chlorate of ammonia in red wine, frequently removed it. Further, the posterior wall of this cyst adheres so firmly to the patella, that it is very difficult to separate them, even by dissection: therefore, some surgeons have contented themselves with removing the whole of its anterior or free portion with the integuments, which it is quite as difficult to separate from them, and it has been observed that, in these cases, the cicatrix is not formed at the expense of the skin, that it does not produce granulations, but that the bottom of the wound becomes dry, hard, and converted into a horny cicatrix. We have not as yet seen this bursa mucosa filled with those cartilaginous corpuscles, which were mentioned when speaking of the elbow and wrist.

Finally, the compact texture and slight degree of vascularity of the subcutaneous layer of the knee render it somewhat difficult to produce an immediate union of its wounds, when attended with loss of substance; wherefore, when we are obliged to operate upon this region, we should preserve as much of the integuments as possible. In consequence also of this disposition, fluids effused into the cellular tissue of the thigh infiltrate but with difficulty below the triceps extensor muscle, so that in œdema of the limb, as well as in fat subjects, the patella and the knee, in general, appear as if depressed, instead of forming a prominence forwards.

III. *The Aponeurosis.*

This membrane is here almost blended with the ligaments; however, it covers the whole of the articulation; only, in the excavations above and below the patella it is thinner and reduced, as it were, to its cellular web; it is thicker externally than inter-

nally, for which reason we find that the synovial bag bulges out more particularly in the latter direction when distended with fluid ; as it is, moreover, attached to the condyles, it slightly binds down the patella, its ligament and the extensor tendon of the leg ; it is confounded with the external aspect of the lateral ligaments, and is continuous with the expansion commonly called *pes anserinus* (*patte d'oie*), so that it forms a kind of capsule which gives some support to the synovial membrane in its natural state ; in short, the aponeurosis of the knee is merely a continuation of the fascia lata, and only differs from it by its fibres being separated in some points, and in others collected into small bandelets or plates, in order to accommodate itself to the osseous prominences and their intervals.

IV. *The Muscles.*

The termination of the triceps extensor, a portion of the tendons of the rectus femoris, and adductor magnus, the *pes anserinus* and the commencement of the popliteus, are the only muscular appendages which we meet with in the knee ; the first, in attaching itself to the external condyle of the femur by means of a very strong tendinous expansion, separates the external *supra-rotulien* fossette from the corresponding femoro-popliteal groove ; internally, it seems to arise from the tendon of the adductor magnus, and in this direction its fleshy fibres are more numerous ; they also descend lower down, and consequently form a more considerable projection ; on both sides they go to be inserted into the margins of the tendinous portion of the rectus femoris ; so that this tendon, which becomes common to the three parts of the triceps, at the same time that it appertains to the principal muscle which has produced it, is kept firmly braced down upon the anterior surface of the femur whilst it draws directly upon the superior portion of the patella. This disposition, which increases considerably the number of the fleshy fibres, also gives much greater energy to the muscular power, by making it impossible for this tendon to deviate from the median line. Notwithstanding its extreme strength, it may be torn by a violent muscular effort, an occurrence which J. L. Petit affirms he has met with three different times. Betwen the tendon of the rectus and the

cruræus, previous to their intimate union, there is an extensible and dilatable cellular bursa, which does not communicate with the joint, and in which we conceive that a fluid may be effused which should not be confounded with a hydarthrosis. There is also a space of some extent above the patella, between the cruræus muscle and os femoris, into which the synovial bag is prolonged to the distance of from one to two inches above the condyles; whence it follows that, in articular effusions the termination of the anterior muscles of the thigh is sometimes very much elevated, and that, notwithstanding the capsule of the joint bulges out still more upon the sides of their middle tendon, in the fossettes above the patella, the superior and anterior part of the synovial capsule is strengthened, in this place, by a fibrous expansion of considerable thickness, and also receives a fleshy slip from the triceps extensor which may be regarded as its tensor muscle. Besides, the adhesion of the extensor muscle to the femur is so loose, its fibres are connected together by a cellular tissue so supple that fluids, which have primitively accumulated within the joint, may detach it, after having perforated the synovial membrane, and extend even to the middle of the thigh; and, on the other hand, inflammation may be primitively developed beneath this muscle, and produce a very large abscess, which it will frequently be difficult to detect, on account of the depth of the fluctuation, which abscess may become extremely dangerous, since it denudes the bone, occasions its necrosis, and also occasionally penetrates into the joint.

From several examples which we might cite, we will select the case of a female sixty-five years of age, who died in November 1824, at the hospital of the *Ecole de Médecine*. This woman was thrown down by a carriage, the wheel of which run over her left thigh. Considerable tumefaction supervened; on the fourth day deep incisions were made, which gave issue to a great quantity of pus. She died on the ninth day. The autopsic examination shewed the femur denuded, and the triceps transformed into a great bag filled with a purulent, sanious and reddish matter; the subcutaneous layer was not diseased. Those phlegmonous inflammations, which have their primitive seat in the abundant and supple cellular tissue which surrounds the femur, are not uncommon. The young patient in the ward *Saint-Come No. 3*, actu-

ally presents a fine specimen of this disease, and there is another of the same nature under the care of Mr. Roux at *la Charité*.

The tendon of the adductor magnus terminates upon the internal tuberosity of the inner femoral condyle, and seems to be continuous with the internal lateral ligament of the joint.

Only a small portion of those of the gracilis, semi-tendinosus and sartorius are found in this region, at the place where they expand upon the tibia, in order to form the *pes anserinus*.

That of the popliteus is remarkable inasmuch as it is at first attached behind the tuberosity of the external condyle, and afterwards turns in order to slide behind the femoro-tibial articulation, and above the superior peroneo-tibial junction; so that it is actually enveloped by a prolongation of the synovial capsule, and concealed by the external lateral ligament, as well as by the tendon of the biceps. From this we may presume that, if an instrument is introduced some lines below and behind the prominence of the external condyle of the femur, it will readily open the sheath of this tendon, and that a wound of this nature might be attended with very serious consequences, on account of the inflammation which would be propagated to the articulation by the continuity of textures.

v. *The Arteries.*

The arterial branches of the knee, derived from the *arteria: articulares superiores et inferiores* and the *recurrens tibialis anterior*, are never so large in the natural state as to occasion troublesome hæmorrhage when divided; but, after the ligature of the popliteal artery, or even in consequence of aneurism of this trunk, they frequently become so greatly enlarged that their lesion might be attended with danger. Then, it is not rare to see the anastomotic arch of the inferior and superior internal articular arteries, as large and even larger than a crow-quill. The same thing is also observed, though less frequently, in the external branches, and they all form together a very complicated plexus, so that in such cases, during operations, the greatest attention is required on the part of the surgeon. There is at present in the museum of the Faculty of Paris, a specimen prepared and presented by M. Ribes, which gives an idea of the state of these parts under such circum-

stances, and shows in what manner the circulation in the leg is re-established after the obliteration of the popliteal artery. By the request of M. Pelletan, Sen'r, we injected and dissected, in 1822, the limb of the subject upon whom Desault tied the arterial trunk of the ham about forty-two years previous. This was the first operation of the kind ever performed in France. The articular arteries were exactly similar to those in M. Ribes' specimen. If it should become necessary to disarticulate the leg under such circumstances, a great many vessels would require the ligature.

VI. *The Veins.*

The saphena is the only vein which deserves our attention here. It is situated between the integuments and the internal femoral condyle enveloped in the subcutaneous tissue, and in such a manner that it may be easily compressed by external bodies, and its circulation thereby impeded: hence varices, infiltrations, etc.

VII. *The Lymphatics.*

They present nothing remarkable.

VIII. *The Nerves.*

Some subcutaneous filaments of the anterior crural descend near to the patella and terminate in the skin. The branch which preserves the name of femoral, and which abandoned the artery before this vessel passed through the adductor muscles, also descends in the superficial layers of the triceps extensor, even to the fore part of knee properly called. Some filaments of the internal and external popliteal nerves equally come to terminate at this point; finally, the internal saphenus also traverses this region in certain subjects, although it appertains more especially to the inner margin of the ham.

From what has been previously said respecting the nerves of the inferior extremity, we perceive that the thigh is principally supplied by the anterior crural, and that consequently it would be possible, by dividing this nerve in the iliac fossa, to paralyze the

extension and the flexion of the leg, as well as the sensibility of the thigh, without destroying the movements of the foot, etc.

IX. *The Skeleton.*

The Skeleton of the knee comprises the patella, the inferior extremities of the femur and the superior of the tibia and fibula ; to these we may also add the numerous ligaments which unite these parts.

(a) The *Patella* greatly resembles the olecranon, at least, in relation to its functions ; but it differs from it by its mobility and by its union with the tibia, although, however, the olecranon has once been found moveable upon the ulna, like the patella upon the principal bone of the leg.* It is developed in the substance of the tendon of the extensor muscles of this limb, about two or three inches above the anterior tubercle of the tibia, and divides this large fibrous bundle in such a manner that its inferior portion constitutes the ligamentum patellæ ; a ligament, which, nevertheless, always fulfils the functions of the tendon, by transmitting to the tibia the action of the muscles of the thigh upon the patella. It follows from this disposition, that the relations of the patella with the tibia do not vary in the different movements of the femoro-tibial articulation, and that, in complete flexion, it is found situated entirely below the condyles of the femur, whilst, in extension, it ascends very high upon the articular pulley of these condyles. In the first position, its posterior aspect is so buried in the interval of the articular surfaces, and these surfaces are so broad, that it would be impossible then to displace the patella, even if the tension of the muscles on the other hand did not oppose it ; but then, it is different with respect to its fracture : for, being placed between its ligament and the tendon of the triceps extensor, which are inserted at an angle into its inferior and superior borders, and its angular aspect resting upon the inferior surface of the inter-condyloid groove, we conceive that a fall upon the knee, added to a violent contraction of the muscles in order to support the trunk, may then occasion its transverse division. In the second position, on the contrary, its fractures are almost

* F. Meckel, *Manuel d'Anat.* etc.

impossible by the action of the muscles alone, and external violence will also with difficulty produce them, on account of the greater mobility of the bone; but, now its luxations would appear at first sight of easy production, although in reality they are very rare. As the surface of the patella is more elevated internally than externally, and thereby seems more disposed to slide in the first direction, one might suppose that it would be more liable to be displaced upon the inner than the outer side of the limb; the contrary, however, is the fact, and the reason is found in the anatomical disposition of the parts. The internal border of the patella is, in fact, much more prominent than the external, and consequently gives a greater purchase to the action of foreign bodies; the anterior facet of the internal condyle of the femur is also more raised than that of the external, which renders it more difficult for the patella to slide inwards. The crest which separates into two the posterior surface of this small bone, being more approximated to the external border of the condyloid gutter than to the internal, it must be more easy to drive it outwards than inwards. Finally, in many individuals the knees incline so much towards each other, that if a line is dropped from the point of origin of the rectus muscle upon the anterior tubercle of the tibia, it will fall upon the outer side of the patella. Now, we cannot deny that, during their contraction, the muscles do not always tend to place themselves parallel to this line; so that, not only will the muscular action assist the external luxation of the patella, when this bone is also driven in this direction by a blow upon its inner border, but we must also admit, with M. J. Cloquet, that this action alone may produce it, which will afford an explanation of several spontaneous luxations; luxations which, on the other hand, seem also to depend upon a relaxation of the ligament of the patella, as in the case related by M. Itard,* or upon the narrowness of the articular surfaces, as observed by M. Boyer,† or finally, upon some other anomaly. With respect to fractures, it is long since Camper has shewn that, being rather the result of the action of the muscles than a blow, the fall, which had been generally considered as the cause of this accident, is really only the effect of it; for the quadriceps femo-

* Journal de Corvisart, etc.

† Traité des maladies chirurgicales, etc.

ris, in this case, contracting with violence in order to maintain the central line of the body, which inclines backwards, loses, by fracturing the patella, its point of support, and its action, as it concerns preventing the loss of the equilibrium, is annihilated. However, we must not believe that, in all fractures of this bone, the fall must necessarily follow the accident; in the work of Sir A. Cooper* there are two cases which evidently prove the contrary.

When the patella is thus fractured transversely, if the fibrous expansion which envelopes it is at the same time torn, the superior fragment may be drawn up very far by the contraction of the extensor, and in such a manner that exact and permanent coaptation, during the time necessary for the formation of the callus, is almost impossible: therefore, Pibrac defied all the surgeons of Europe to shew him a fractured patella re-united without an intermediate fibrous substance. Modern authors had even admitted that the nature of this bone did not admit of any other mode of union; but M. Lallement of the Salpêtrière has proved that a perfect callous union was possible, and another similar specimen has since been found in Hunter's Museum; Wilson† and C. Bell,‡ according to S. Cooper, have each equally met with an example of the same kind. Be this as it may, the substance interposed between the fragments, if it does not exceed a half inch, will give as much strength to the patella as an immediate re-union. So that it is useless to torture the patient in order to obtain the latter, and for the numerous bandages invented for this purpose we may advantageously substitute position of the limb, to which we may add the uniting bandage for transverse wounds; proposed by Desault, in those cases only where it appears necessary to oppose the tonic action of the muscles upon the superior fragment. At the hospital St. Louis, M. Richerand places the limb of the patient upon a pillow greatly and regularly inclined from the heel towards the pelvis, whilst the trunk is at the same time raised to such a degree as to form nearly a right angle with the thigh, as proposed by Richter; and we have been able to ascertain that the re-union was as complete and especially accompanied with less inconvenience and fatigue than would

* Surgical Essays, etc. † On the structure, etc. of the Skeleton. ‡ On Injuries, &c. of the thigh bone.

have attended the use of the most complicated and ingenious mechanical contrivances. It must be observed, however, that the fibrous substance which forms the bond of union between the two fragments may be destroyed by ulceration, and thereby leave the articular surfaces exposed; an example of which has been related by Sir A. Cooper. Difficult as it may be to retain the parts in apposition in the transverse fracture, so, on the other hand, does it appear easy, when the patella is divided parallel to the axis of the limb; and the observations of Petit, Desault, Sabatier and M. Dupuytren fully confirm this assertion. Indeed, the muscular contractions, then, tend much more to approximate than to separate the fragments; whence it follows that this species of fracture can only be produced by a direct cause, and that, in order to obtain a sure and prompt consolidation, it is sufficient to keep the limb extended and immoveable.

When the tendon which is inserted into the base of the patella is completely divided, it becomes impossible to straighten the leg; for, although the two lateral portions of the triceps pass upon the sides of the condyles of the femur, they can only act upon the leg, however, through the medium of the patella. Since the action of the muscles sometimes breaks the patella, it is not at all surprising that they can occasion the rupture of the ligament of this bone, and even that of the tendon of the triceps.

(b) The *femur* is remarkable here for its volume, for the disposition of its condyles and for its spongy nature. It is seldom fractured in this region, but when it is, as the inferior fragment is not supported by the muscles of the thigh, those of the leg cause it to swing backwards. We also conceive, if the fracture is very oblique from the body of the bone towards the articulation, that one of the condyles will be completely separated, as M. Delpech has observed;* and as the internal is the longest and thinnest, it is naturally more exposed to this accident than the external. When we reflect upon the transverse extent of these two condyles, we soon acquire the conviction that a complete luxation, in this direction, is impossible without a dreadful destruction of parts; even a partial dislocation is excessively difficult, for it cannot take place without one of the condyles rising upon the *spine of the*

* Des maladies réputées chir. etc. 1816.

tibia,* and the rupture of the lateral ligaments. In order that the condyles also should be displaced forwards or backwards, they must slide over an extensive space ; but in flexion, as their posterior portion alone rests upon the facets of the tibia, we conceive the possibility of their luxation forwards. In extension, on the contrary, as they rest upon the tibia by a large surface, and as the crucial ligaments are very tense, an extraordinary force is requisite to produce luxation backwards. As the volume of this portion of the femur and its condyles is owing to the rarefaction of its tissue, it follows that it does not possess any medullary canal, and that it receives a greater quantity of vessels than its middle part : therefore, it is frequently the seat of caries, spina ventosa, and other affections of this nature, whilst necrosis very seldom attacks it.

(*c*) The *tibia* here presents its tuberosity, which, as we know serves as a boundary in amputations of the leg ; nevertheless, if we observe that the ligament of the patella adheres to the bone nearly an inch above the point of termination of this fibrous bandelet, we will admit, with M. Larrey, that amputation is practicable, even when we are obliged to saw higher than the anterior tuberosity, and that if we then make the section very obliquely from before backwards, or from the spine of the tibia towards the posterior part of its condyles, we might remove at the same time the head of the fibula. It would, without doubt, be unpleasant to be reduced to these extremities ; still it would be much better to operate in this manner, than to amputate in the joint, or to ascend to the thigh. Above the tuberosity of the tibia there is a triangular surface, which is concealed by the ligamentum patellæ, from which it is separated by a cellulo-adipose tissue which sometimes forms a very distinct bursa mucosa, and which may become distended with fluid ; so that this pouch, which we might then consider as a complete cyst, would also admit of the same treatment as these tumours, and would, consequently, be much less dangerous than those which are formed by the synovial capsule. Furthermore, it appears pretty evident that this membrane or bursa is owing to the alternate separation and approximation of the ligament of the

* A pyramidal process, with a broad base, inclined obliquely upwards and inwards, surmounted by two tubercles and separating the two articular cavities of the tibia.—*Transl.*

patella and the triangular facet of the tibia, during the movements of flexion and extension of the limb.

(d) The *head of the fibula* is easily felt about an inch and a half below the external condyle of the femur ; it is immoveable, and does not merit any attention in surgery except in relation to amputations ; and even then, only when we are obliged to saw through the bone very near to the knee. Then, it is asked, will not this small osseous portion, jarred by the action of the saw, and moved at each dressing, give rise to unpleasant consequences, and would it not be better to remove it by an after stroke ? Finally, it is upon it that we apply the blister recommended by Cotugno, in sciatic neuralgia.

(e) The *Synovial membrane* which covers the articular surfaces of the knee is the most extensive in the body ; and if we add to this the pressure which it continually experiences, whether from standing or walking, we need not be astonished at the numerous diseases which too often affect it. Behind the ligament of the patella, it is repelled towards the interior of the articulation by a species of adipose cushion, the fibrous lamellæ of which are collected into a small cord, which is inserted into the fore part of the notch which separates the two condyles. This ligament, which we call *adipose*, being enveloped by the synovial capsule, seems to divide the anterior half of this membrane into two portions ; so that, in *hydrops articuli*, the fluid always has a natural tendency to protrude at the sides of the *ligamentum patellæ*. We have already said that this tunic was prolonged very far, in the form of a *cul-de-sac*, under the *triceps extensor* : it is also reflected upon the sides of the *trochlea* of the femur, and upon the circumference of the head of the tibia below ; but, in general, it is supported opposite to the external and internal articular depressions, by the lateral ligaments and the fibrous expansions which were mentioned when speaking of the *aponeurosis* ; whilst, in the points corresponding to the four *fossettes* above and below the patella, as well as to the lateral grooves of the knee, the tissues are extensible and very supple ; therefore, it is in these situations that it becomes most prominent, when distended by any liquid whatsoever. As these different points indicate so many excavations, it follows that, if we wish to apply an exact compression around the knee, for a slight effusion into the synovial

membrane, or for any other disease, that we should cover them with graduated compresses.

Every one knows that the synovial capsule of the knee occasionally contains those foreign bodies which we call cartilaginous, although most frequently they are of a very different nature, similar to those which are sometimes found in such great numbers in the wrist, etc., excepting that they are seldom multiplied, and that they always present a pretty considerable volume. When they are free in the joint, the movements of the limb must naturally drive them to one of those points where the synovial membrane is most supple, and it is there that we must seek for them. In this state, it doubtless would be very difficult to say by what mechanism they are formed; but as, in certain cases, we have found them penetrating, so to say, from without into the articulation, by enveloping themselves with the synovial membrane which they drive before them, and as, at other times, they are still connected to this membrane by a pedicle, Bécларd has thence concluded that they always formed towards the surface, and that they only penetrated secondarily into the joint. This opinion is, at least, more satisfactory than that which admits that these bodies are only cartilaginous particles, detached from the articular surfaces.

Let the mechanism of their formation be what it may, these foreign bodies nevertheless occasion the most acute pains, whenever they become displaced, during certain motions of the limb. It is unfortunately too true that their extraction is generally attended with the greatest danger; so much so that, in these cases, B. Bell proposed amputation! We have seen these bodies extracted but once; the operation was performed by M. Richerand upon the knee of a young person, in the ward St. Marguerite, at the hospital of St. Louis. The subject was in the best possible condition; the foreign body of the size of a chesnut* was removed with promptitude and facility. Every thing went on well until the third day; then the knee began to swell and fever set in; the whole of the joint soon became the seat of an enormous abscess; other abscesses formed in the thigh, and for three weeks her life was in extreme peril; this patient finally recovered, but

* The French chesnuts are at least twice the size of those which grow in this country.—*Transl.*

at the expense of an ankylosis, after three months of most severe suffering, and under the most energetic treatment.

The order of superposition, will be particularly examined after we have studied the popliteal region; when we will also speak of amputation.

Sect. 2. Popliteal, or Posterior Region of the Knee.

The surface of this region somewhat resembles that of the bend of the elbow. We find upon it, inferiorly, an eminence, constituting the origin of the calf of the leg, which becomes narrower as it ascends, and pretty rapidly disappears in the hollow of the ham. Above, we observe a deep triangular excavation, the apex of which is prolonged more or less into the posterior femoral region, becoming continuous with the median *femoro-popliteal groove*. This excavation is the hollow of the ham, properly speaking, which is very deep when the leg is semi-flexed, but almost entirely disappears when the limb is extended; its base seems to bifurcate in order to embrace the preceding eminence, and the two branches of this bifurcation are insensibly lost upon the sides of the leg. Of the two ham-strings which circumscribe it, one is external and is formed by the biceps or its tendon; the other internal, and is produced by the combined tendons of the sartorius, semi-tendinosus, gracilis and semi-membranosus muscles. In order to make the first of these borders tense and very prominent, the leg must be flexed, and the point of the foot at the same time turned outwards. In this position, the depth of the *external femoro-popliteal excavation* is much augmented, and gradually disappears in the posterior surface of the thigh. In order to render the other very prominent, it is, sufficient, the leg being already semi-flexed, to try to flex it still more, whilst the heel is fixed against a solid body. At this moment we may also feel through the skin a groove, which separates the tendons of the gracilis and semi-tendinosus, and we see that this margin is continued very far upon the internal part of the posterior femoral region. It is proper to note that when the ham-strings are put on the stretch they are about two inches in breadth, the inner one even a little more; whilst, when the limb is extended, they almost entirely disappear, or are very

nearly on a level with the posterior face of the femur ; whence it follows that, in the first case, they might be divided transversely by a cutting instrument directed upon their free border, without the artery being involved in the wound, and that in the second, on the contrary, the vessel would be wounded before it reaches the ham-strings. In this position also, a ball, or sword might penetrate these borders, from the inner to the outer side, for example, in such a manner as to pass freely behind the femur, and even behind the popliteal artery, which, however, would then be in great danger of injury ; whilst, if the leg is extended, these vulnerant bodies would inevitably strike against the os femoris, which would not fail to stop them.

CONSTITUENT PARTS.

I. *The Skin.*

It is much more delicate, supple and extensible than anteriorly ; gives origin to some hairs in man and is generally smooth and sleek, but in certain cases presents some transverse wrinkles.

II. *The Subcutaneous Layer.*

It is thinner and more lamellated than in the thigh, but thicker and less dense than in the anterior region of the knee. Fat is sometimes developed in it to such a degree as to form a pretty dense layer ; it also includes all the elements which contribute to the formation of phlegmons and abscesses, but the internal saphena vein, which sometimes traverses it on the inner side of the internal ham-string, is the only organ worthy of being mentioned.

III. *The Aponeurosis.*

If we take this *fascia* in the middle of the popliteal excavation, and trace it to the biceps we, will find that it splits in order to form a sheath for this muscle, its external sheet becoming continuous with the aponeurosis of the anterior region, whilst the internal is finally blended with the periosteum of the femur ; on the inner side, it also separates, in order to form a canal for

each of the muscles, or tendons, which constitute the inner hamstring: but, as the tendons of these different muscles terminate in a membranous expansion, when they arrive upon the internal surface of the tibia, it follows that their different sheaths become blended, in order to form one of the points of origin of the aponeurosis of the leg, with which that of the ham is continuous, without any line of demarkation. Inferiorly, we may make it depart from the cutaneous surface of the external condyle and of the head of the fibula, or rather from the border of the biceps, in order to follow it transversely to the posterior margin of the *pes anserinus*; it thus binds down the middle muscular prominence, or the commencement of the calf; here, its fibres run obliquely or across each other; in the first point, that is to say, in the femoral portion of the region, their principal direction is transverse; its deep-seated laminæ become rarefied in such a manner, in the popliteal space, that they blend themselves with the fibro-cellular tissue which envelopes the nerves and the vessels. From this position of the aponeurosis, we see that the ham may be the seat of superficial abscesses and of deep-seated abscesses; but that neither the one nor the other will have so great a tendency to extend into the surrounding regions, as those which manifest themselves in the groin, for example; finally, although this fascia is so strong as to oppose a certain resistance to the developement of aneurismal tumours, it does not long restrain the progress of these diseases.

IV. *The Muscles.*

These organs circumscribe a large diamond-like space which we may divide into two triangles, by drawing a transverse line on a level with the condyles of the femur. The superior of which, or *femoral* triangle, is the largest, and constitutes the popliteal hollow; the inferior, or *tibial*, is only a prolongation of the former, and separates the origins of the gastrocnemii muscles.

The biceps muscle forms the external boundary of the femoral triangle, and it is here that the fibres of its short portion run obliquely from the external labium of the linea aspera upon the tendon of its ischiatic portion; so that the principal use of the femoral branch of this bundle seems to be to give more power

to the other, by preventing it from removing too far from the bone of the thigh, during the flexion of the leg. Enveloped in the laminæ of the aponeurosis, it slides upon the external and posterior part of the outer condyle of the femur, in order to reach the head of the fibula ; so that it is separated from the articulation by a pretty thick fibrous expansion, which prevents it from drawing upon the synovial capsule during its contractions.

Of the four muscles which form the inner ham-string, the most superficial, in the direction from within outwards, is the *sartorius*, which continues fleshy until near to the internal femoral condyle : but, as its tendon is thrown inwards and backwards by this protuberance, before it expands upon the internal surface of the tibia, it follows that it there acts as upon a pulley, and in such a manner that it draws the leg in adduction at the same time that it bends it.

When the *gracilis* reaches this region, it is almost entirely tendinous ; and from its direction and insertion into the tibia, must approximate the thighs, whilst it favours the flexion of the leg.

The *semi-tendinosus* is more prominent behind than all the others ; which is owing, on the one hand, to its being fixed upon the ischiatic tuber, above, and on the other, to its descending lower down than the others upon the tibia. Hence, when the limb is flexed, it is very distant from the femur, whilst the two others, being inserted superiorly upon a point anterior to this bone, cannot remove so far from it ; besides, it draws the point of the foot very much inwards.

Finally, the *semi-membranosus*, the largest and strongest, is the most deeply situated ; it is found external to the others, and closer to the femur ; that is to say, it forms the internal paries of the popliteal hollow, without being connected, at all times, to the internal branch of the inferior bifurcation of the linea aspera, otherwise than by the aponeurosis which forms a sheath for it ; which must establish a difference between the two borders of the ham, because the short portion of the biceps is attached directly to the bone. In passing backwards and inwards from the internal condyle of the femur to its insertion into the corresponding tuberosity of the tibia, the tendon of the semi-membranosus is the nearest to the articulation, which it strengthens in a still more immediate manner by sending a fibrous expansion over its posterior surface :

an expansion which is blended with the posterior ligament of this joint, and which seems destined to draw out the synovial membrane from between the articular surfaces, during the movements of flexion of the leg.

The inferior or tibial triangle is formed by the separation of the *gemelli* or *gastrocnemii* muscles. They originate above the condyles, and are, as it were, encased by the tendon of the biceps externally, and that of the semi-membranosus internally: when the leg is extended, they are reflected upon the posterior femoral protuberances as over a pulley; so that when the femur is fractured in its inferior fifth portion, they have a constant tendency to make the fragment to which they are attached swing backwards; therefore the flexion of the limb is then the only position which will admit of an exact coaptation.

The *plantaris*, remarkable for its exiguity, would not deserve any attention here, if, as it is passing from the superior part of the external condyle before the soleus to the leg, it did not cross the popliteal vessels and nerves, in such a manner as to be able to compress them when the leg is forcibly extended.

The *popliteus* turns from without inwards and from above downwards behind the articulation, which it crosses, and against which it is applied; its posterior surface is covered by a lamina which is continuous with the fibrous elements of the joint, above, and makes a part of the deep aponeurotic sheet of the leg below; so that this muscle is bound down upon the posterior aspect of the bones.

Finally, the point of origin of the *soleus*, ascending almost to the head of the fibula, is also found in this region, where we also meet with its aponeurotic arcade; an arcade which bears a much greater resemblance to that which unites the two crura of the diaphragm, than to that through which the femoral artery passes where it enters the popliteal region; that is to say, that it is formed by a fibrous band which passes behind the vessels and nerves, uniting the peroneal and tibial portions of the muscle to which it appertains.

v. *The Arteries.*

The Popliteal artery, continuing the femoral, extends from the perforation in the adductors beneath the arcade of the soleus;

in this tract its direction is oblique from within outwards, since superiorly it is found in the internal margin of the ham, whilst inferiorly it lies nearer the external border of the leg than the internal. Anteriorly, it is in relation with the posterior face of the adductor magnus, of the femur, of the articulation and its capsule, with the popliteus muscle, and is, in general, separated from these parts only by a thin layer of cellular tissue or of adipose vesicles; whence it follows that, in traversing the joint, for the purpose of removing the leg according to the method of Brasdor, we should use the greatest caution in order to avoid dividing the artery previous to forming the posterior flap; so that also, it is possible to compress this vessel against the femur in the middle of the popliteal hollow. Posteriorly it is covered directly by the vein which is, at the same time, external to it; it is still more intimately connected with this vessel here than in the thigh properly called, so that it might be readily perforated by the beak of the sound in attempting to pass a thread around the artery. More posteriorly and a little more externally also, is found the internal popliteal (*tibial*) nerve, then the cellular lamellæ, some fat, and the aponeurosis: internally, it at first runs almost immediately along the external surface of the semi-membranosus muscle then at a somewhat greater distance from it, as far as opposite to the internal condyle; externally it contracts the same relations with the biceps muscle; in the inferior half of the region it is concealed in the condyloid notch by the popliteal vein and nerve, which lie posterior to it, and laterally by the heads of the gemellus, and it is also crossed, as we have said, by the plantaris muscle, previous to penetrating under the fibrous arch of the soleus. Besides, the popliteal artery is also enveloped by some lymphatic glands, fat and cellular tissue, which fill more or less completely the hollow of the ham: therefore, it is very difficult to expose it in the midst of all these parts. From the relations, however, which have been just pointed out we will easily arrive at it by incising, in the direction of a line drawn from the median point of the posterior aspect of the femoral condyles towards the middle of the posterior surface of the inner border of the thigh, the skin, cellular layer, the aponeurosis, other fibrous laminæ and some fat: we would then have to draw the internal popliteal nerve and the vein of the same name outwards, if we wished to perform this operation above the con-

styles; behind the articulation, on the contrary, or still nearer its termination, we would have to divide the same layers, and also to separate and, in certain cases, even incise, the origin of the gemelli muscles as well as the plantaris. Finally, we would have here the nerve, applied immediately upon the artery and vein, and rather internally than externally; add to these the proximity of the joint, and you will have an idea of the difficulties and dangers of this operation when performed in the lower portion of the popliteal region. These difficulties are such that, unless traumatic lesions exist, we should prefer the ligature in the fold of the groin. Since Desault, in fact, operated for an aneurism in the ham after the method successfully practised by Anel in 1713, for a similar tumour at the bend of the arm, surgeons generally have adopted this idea, varying the process somewhat in order to bring it to perfection.

Although it does not enter into our plan to examine whether the new method of tying arteries for the cure of aneurisms should bear the name of Anel, of Desault, or of Hunter, let us, nevertheless, be permitted to observe that this question should no longer remain undecided. It is, in fact, granted, that the capital point, in this method, is to place a ligature above the tumour, without opening it. Now, who is it that first adopted this method in relation to the brachial artery? It was Anel. Who first applied it to the popliteal artery? Desault; since Hunter did not perform his operation at St. George's Hospital, London, until the month of December, 1785; whilst the celebrated surgeon of Hotel Dieu had executed his in the month of June of the same year. Now what is the difference between the methods of these two authors? one placed his ligature a little nearer the tumour, and the other a little further distant: that is all. But, they say, this difference, so slight in appearance, is in reality of immense importance as to its results, and all the advantages appertain to the process of the English surgeon; which is a sufficient reason why we should grant to him the honour of the application. But, in our opinion this deduction is not correct; for, on the same grounds, we should no longer say the method of Hunter, but the method of Scarpa. In fact, it would not be difficult to prove that the process of Scarpa, which is at present generally adopted, is as far preferable to that of Hunter, as the method of

the latter is to the operation of Desault ; yet, notwithstanding, the surgeon of Pavia has not attempted to attach his name in an exclusive manner to the new method of treating aneurisms. Therefore, we may justly conclude that the fundamental idea of the method appertains to Anel ; that Desault first applied it to the inferior extremity ; that the best modification of the operation appertains to Scarpa, and that Hunter, having had the good luck to save his first patient, has obtained the greatest credit among his professional brethren. We trust that we will be pardoned for this slight digression : we considered that the facts had not yet been traced to their source, and that the question had not been presented in its proper point of view. We think, with M. Richerand, that those who render themselves useful to their fellow men, by their important discoveries in the sciences, belong to every country, and that they deserve praise from one pole to the other ; but it seems to us also, that each nation may, without being taxed with egotism, claim for itself and attach to its own soil, the discoveries or improvements which are its property, and which tend to increase its scientific glory.

Let us remark, in continuation, that several authors attribute the great frequency of popliteal aneurisms to the relations of the artery. M. Richerand, for example, maintains that this vessel may be ruptured by a violent and sudden extension of the limb, because, in this movement, the articulation becomes prominent behind ; and we might add, because it is at the same time stretched by the tractions of its two extremities, each of which are confined by a fibrous opening. Several celebrated surgeons reject this opinion, affirming that, upon the dead body, the most forcible extensions never produce laceration of the artery. Scarpa derives these diseases from a much more natural cause, viz : a diseased state of the tunics of the vessels ; but, it seems to us that one of these explanations does not destroy the other, and that, on the contrary, they may act very well in concert. In fact, on the one hand, although a sound artery may resist the motions of the knee, it does not follow that it will present the same resistance when diseased ; on the other hand, the arterial tunics may be for a long time in a pathological state, without an aneurism necessarily manifesting itself, unless some effort or other accident determines its formation. Be this as it may, the devel-

opement of these tumours presents some peculiarities relative to the point which they occupy, and which we must now examine. Thus, whenever a tumour is situated in the lower half of the popliteal artery, the resistance which it will experience on the part of the condyles and gemelli muscles, as well as from the aponeurosis, will cause it to extend upwards into the popliteal space, where the tissues are better calculated to yield to distension. If, on the other hand, it occupies the place where the artery escapes from the perforation in the tendon of the adductor, the same will take place, but in an inverse direction: then, in fact, the semi-membranosus, and biceps muscles will oblige it to descend, by opposing its ascension into the posterior femoral region; so that, in almost all cases, the aneurism, if of moderate size, will occupy the middle of the popliteal space, whether the perforation of the artery exists above, below, or in the centre of the region.

Let us also note that, in all cases, the tumour being compressed by the aponeurosis, which is very strong posteriorly, and by the muscles which are not less so laterally, must re-act powerfully against the posterior, broad and spongy portion of the femur, and will thereby greatly dispose to the absorption of the osseous molecules: therefore it is not very uncommon to see this bone broken or destroyed in consequence of popliteal aneurism. We will moreover, have an idea of the effort which this artery will then exercise, if we observe the movements which it communicates to the limb when semi-flexed, and thrown over the opposite knee, so that the popliteal space rests upon the latter.

The *superior articular arteries* arise; the external, from the popliteal, as soon as it has received this name, or even from the femoral, whilst passing through the tendon of the adductors; the internal, above the corresponding condyle, and the median, behind the joint. It is always pretty easy to place a ligature between them; and as, moreover, they are generally of but moderate size, they cannot hinder the formation of the adhesive clot above the point embraced by the ligature. The first, going to lose itself principally in the short portion of the biceps and vastus externus is the most superficial; the second, making a turn above the condyle, between the semi-membranosus muscle and the tendon of the adductor magnus, in order to arrive at the knee, and in the vastus internus, lies much nearer the bone and is conse-

quently deeper; the third, traversing perpendicularly the posterior ligaments of the joint, and distributing itself principally to the synovial membrane, the cellular tissue and all the fibrous parts of this articulation, is still more out of the reach of injury; so that, in seeking for the popliteal artery in the direction of the line which we have pointed out, it is always possible to avoid the superior articular arteries.

The two inferior articulares and surales, detaching themselves from the trunk below the inter-condyloid notch, in order to make a turn under the head of the tibia, between this bone and the lateral ligaments of the joint, or to penetrate the gastrocnemii muscles, might be equally avoided; but as their origins are very near each other, perhaps it would not be very prudent to place a ligature immediately below them. Furthermore, we conceive that the numerous and very large arches formed by the anastomoses of these different branches with each other, must readily re-establish the circulation in the limb, when we apply a thread upon the popliteal, between their points of origin, between the first and second for example. We may also say that their communications with the perforantes are such as to give reason to apprehend the return of the pulsations in a popliteal aneurism, when the femoral has been tied above the perforation in the adductor. In fact, this is what sometimes does happen, and some surgeons have at first been alarmed at it; but observation has proved that these pulsations do not continue, and reasoning teaches us that they cannot easily prevent the coagulation of the blood contained in the aneurismal sac.

The other branches, given off by the popliteal, are too small and too irregular to merit any attention. We may observe, however, that the *anastomoticus magnus*, which was spoken of when on the anterior femoral region, is found in the popliteal region, and that it descends to the internal condyle of the femur, parallel to the tendon of the adductor magnus, upon the anterior part of which it is applied.

VI. *The Veins.*

We made mention of the internal saphena, when on the knee. The external slides gradually between the laminae of the aponeu-

rosis, from below upwards and from behind forwards, in order to discharge itself into the popliteal vein, above the condyles of the femur; from which circumstance the garters never compress it when tied above the knee, whilst the internal saphena is equally compressed, whether they are placed above or below this prominence. We also see that this vein cannot be in the way, when we apply a ligature upon the artery, unless in case the operation is performed in the inferior triangle of the popliteal space; but, then, it is so large that it is very necessary for the surgeon to avoid it; which may easily be done by not incising too much outwards.

All the deep-seated veins are disposed as the arteries; only, they are a little more superficial. The popliteal, situated directly behind the artery, whilst these two vessels pass through the adductor muscles, slightly inclines outwards, as it enters the superior triangle of the region, so as to rest behind and upon its external side, as far as on a level with the condyles; whereas, when it passes over the posterior surface of the articulation, it replaces itself behind it, and, finally, at the lower part of the region, gets upon its inner side. In consequence of this disposition it follows that, in order to separate the artery from the vein, in the superior part of the space, or even in the inter-condyloid notch, we may introduce the needle almost indiscriminately on either side; whilst, behind the femur we should always insinuate it between the vessels, at its external side only, and at its internal, on the contrary, if we wish to apply the ligature immediately above its passage under the arcade of the soleus. Besides, their union is so intimate that it is necessary to be cautious when separating them. Although the sheath which envelopes these two trunks is supple and mixed with fat, it nevertheless presents some resistance; and, as the coats of the vein are very soft, it would be very easy to perforate them, if we do not use the necessary precaution.

VII. *The Lymphatics.*

The superficial set presents nothing remarkable; but in the deep-seated we find a certain number of glands which deserve much attention, on account of their relations. These glands are

four or five in number; they surround the vascular trunks* in such a manner, that there is one on the inner, another on their outer side; the third between the artery and the femur, and the fourth posteriorly. Although this disposition is not constant, it is nevertheless somewhat frequent; so that, if these organs were developed by disease we conceive that they might, on the one hand, compress the artery and vein, so as to occasion infiltration or torpor of the limb, by interrupting the circulation of the black blood and red blood below the ham; and on the other, from their application to the vessels, may have the arterial pulsations communicated to them and thereby be mistaken for aneurism. Finally, we may remark, that a true aneurism may also occasion their tumefaction, whereby they may form one or more knobs upon its sac, which knobs might embarrass the surgeon if he should operate upon the arterial tumour according to the ancient method.

VIII. *The Nerves.*

These are the two popliteal branches (*tibial and fibular nerves*) together with the filaments which they send off; as they are formed by the bifurcation of the sciatic, it follows that, superiorly, they are both situated upon the outer side of the artery, and that they diverge in descending.

The external popliteal (*fibular or peroneal nerve*) passes externally and behind the corresponding condyle of the femur, and gradually approximates the internal surface of the biceps muscle; as it proceeds to the outer side of the head of the tibia it becomes broad and flat, and is soon found below and behind the head of the fibula. In turning upon this bone, in order to pass before the leg, it leaves the muscles of the calf within and the peronæus longus without, so that it is at first subcutaneous in the small space which exists between the external gemellus, the biceps flexor cruris, and the peronæus longus; therefore, it is in this place that it is necessary to apply the vesicatory recommended by Cotugno in femoro-popliteal neuralgia, and that we might divide the nervous cord itself. The musculo-cutaneous (*external fibular nerve*) is detached from this branch about an

* Harrison, vol. 2.

inch or two above the external condyle of the femur, and creeps between the laminæ of the aponeurosis, in order to pass upon the posterior and external surface of the calf.

The internal popliteal (*tibial*) nerve seems to be the continuation of the great sciatic; it descends parallel to the axis of the limb; is at first situated on the outer side of the vein, but afterwards crosses the posterior surface of this vessel very obliquely, so that below the condyles of the femur it is found on its inner side. Of the three important organs of the popliteal space this lies nearest to the skin; it sends off a branch sometimes a little higher than at others, but always above the femoral condyles, which soon reaches the calf and places itself on the inner side of the external saphena vein; this is the principal root of the external saphenus nerve. It cannot be wounded, when operating for the ligature of the artery, except in those cases in which the incision falls on the outer side of the popliteal trunk itself; neither will it be confounded with the vessels, if we recollect what we have just said in relation to its position. Previous to its entrance under the solæus muscle, it gives off another branch of a certain volume, which follows the posterior surface of the artery, and which we would avoid with difficulty if it was required to tie this vessel quite low down.

IX. *The Skeleton.*

It comprises only the posterior part of the articulation, and enters into that of the anterior region: thus it is composed of the triangular surface of the femur; of a surface nearly similar which appertains to the tibia; of the posterior part of the condyles of the femur and of the notch which separates them. The condyles should be attended to, especially on account of the prominence which they form behind, because they thus pass beyond the artery; so that, if the limb is not semi-flexed, when we are disarticulating it at the knee, the instrument will divide the vessels before it has passed through the joint. Now, if we examine the order of the superposition of parts in the principal points of the knee, we will find—

(a) In the femoral portion of the popliteal region, 1st, the skin pretty supple and extensible, yielding to the enormous devel-

opement of certain tumours ; 2d, the subcutaneous layer, enclosing no important organ, and in which superficial abscesses form ; 3d, the aponeurosis, strong and with transverse fibres, in the middle single, and unfolding at the sides for the purpose of enveloping the ham-strings ; 4th, the popliteal hollow, filled with fat, fibro-cellular lamellæ, some lymphatic glands, and especially by the popliteal nerves, vein and artery, which present themselves in the order in which they have been mentioned ; a hollow which is, consequently, well calculated for the formation of abscesses, and the developement of all kinds of tumours ; 5th, on the inner side of this hollow, its internal boundary, or the tibial margin of the ham, constituted by the semi-tendinosus, gracilis, sartorius, semi-membranosus and adductor magnus muscles or tendons, an abstraction being made of the arterial branches and vena saphena interna ; 6th, externally, the external border of this space, formed by the biceps ; 7th, lastly, the femur.

(*b*) In the tibial portion, 1st, the skin, a little more unyielding than in the preceding point ; 2d, the subcutaneous layer, which includes the termination of the external saphena vein, and the superficial branch of the internal popliteal nerve ; 3d, the aponeurosis, thinner, but still of considerable strength notwithstanding ; 4th, the tibial triangle of the region, filled by fat also and by the same organs which are found in the superior triangle, with the exception of the fibular nerve and lymphatic glands ; 5th, upon the sides of this triangle, the origins of the gemelli and plantaris muscles ; 6th, the posterior prominence of the condyles, the posterior ligament of the joint, and still lower the popliteus muscle ; 7th, finally, the tibia and the head of the fibula ; so that all the soft parts, united with each other and separated from the bones, may form a flap of pretty considerable thickness.

(*c*) In the region of the knee, above the patella, 1st, the skin, covered with hairs and wrinkled ; 2d, the subcutaneous layer ; 3d, the thin aponeurosis ; 4th, the tendon of the rectus muscle ; 5th, a species of bursa mucosa behind this tendon ; 6th, the cruralis muscle ; 7th, the prolongation of the synovial membrane and the muscular bundle which covers and is attached to it ; 8th, the femur.

(*d*) Below the patella. 1st, the skin very thick and of slight extensibility ; 2d, the subcutaneous layer, thick and lamel-

lated; 3d, the aponeurosis; 4th, the ligamentum patellæ; 5th, the mucous bag which separates this ligament from the tibia, the fatty cushion; 6th, the adipose ligament; 7th, the interior of the joint in which we find the cartilaginous pulley of the femoral condyles, the semi-lunar fibro-cartilages, the anterior crucial ligament, the spine of the tibia between the two articular cavities of this bone, and the posterior crucial ligament; 8th, the popliteal region. Therefore, if we wish to remove the leg, it will be necessary in order to arrive at the posterior ligament of the joint, to feel with the thumb and index finger, internally and externally, below the condyles, for the articular groove, in order to open this articulation extensively, by making a semi-circular incision below the patella; then, by dividing the lateral ligaments, one after the other, with the point of the knife, we may carry it through the joint, cutting the crucial ligaments, and leaving upon the tibia the semi-lunar fibro-cartilages; but we should be careful not to direct the point of the instrument too far back, for we would very easily wound the popliteal artery. This being done, it only remains to form a flap at the expense of the muscles of the calf, by carrying the knife flat-wise upon the posterior surface of the bones of the leg, without touching the vessels, until an adroit assistant can pass his thumb before the base of this flap, between the bones and the flesh, in order to compress them whilst the operator divides them four or five inches below.

In this manner, we preserve the patella and a species of anterior flap, which renders it unnecessary to give so much length to that which we cut behind. All the fears with which the presence of this bone inspired J. L. Petit, are, indeed, chimerical; but this operation should not, on that account, be the less proscribed by good surgery. In fact, the great breadth of the osseous surfaces will always render an immediate union very difficult, and if we can find sufficient sound parts behind to cover them, it will always be possible to amputate lower down; afterwards, even when the patient is cured, it will not be strictly correct to say that the stump may be supported upon the artificial leg, for he will not be the less obliged to make use of a cuish. So that, in this respect, the disarticulation of the knee is far from possessing any advantages over the amputation of the thigh above the condyles. If M. Richerand had not declared, the last year, in his lectures on operative medicine to the Faculty, that he would no more per.

form this operation, although he had just performed it upon a young man who perfectly recovered, we would enter into further anatomical details, in order to shew that this operation should forever be banished from surgical practice.

ART. IV. OF THE LEG.

The leg is comprised between the circle which forms the inferior boundary of the knee, and a second circular line placed above the malleoli. Its form is that of an irregular cone, with its largest extremity turned upwards. Upon its surface we observe, anteriorly, upon the median line, a crest which extends from the tibial tuberosity to the lower part of the region, becoming rounder as it descends; this is the crest of the tibia. On the outer side of this crest, we see an inclined plane, which corresponds to the muscles of the anterior and external region of the leg; posteriorly, a considerable prominence, broad and very convex superiorly, where it constitutes the calf, becoming gradually narrower as it descends, so as to form a species of cord which represents the tendo Achillis: in the state of contraction, the calf properly called is separated into two portions by a double groove which corresponds to the point of separation of the gemelli and soleus muscles. Externally, the posterior prominence is blended with the anterior plane; but, as it descends, it becomes separated from it by a groove, which is at first quite superficial, but at the lower part is of considerable depth. This groove corresponds to the interval which exists between the soleus and lateral peronei muscles, then between the tendo Achillis and fibula; so that, anterior to this groove, this bone may be felt naked under the skin. On the inner side there is another gutter which separates the calf and tendo Achillis from the tibia, throughout the whole length of the leg, but in such a manner, that, superiorly, this groove falls upon a cellulo-adipose space which is limited, anteriorly, by the internal border of the tibia and the tendon of the gracilis above, and posteriorly by the gemellus internus; so that this is the proper place for the application of caustic or the introduction of setons. In order that these objects may be properly examined, it is necessary to divide the leg into three regions: one, anterior and internal, another, external and anterior, and a third. posterior. The latter is separated from the two others by the continuation of the

coxo and pubio-malleolar lines, and the internal is separated from the external by the crest of the tibia.

Sect. I. Anterior and External Region.

It comprises all the soft parts resting upon the anterior fossa which is circumscribed by the bones of the leg. Broader superiorly, and especially in the middle, where it is convex, than inferiorly, where it is rounded and blended with the internal aspect, this region presents, during extension, only different prominences and divers depressions, occasioned by the contraction of the muscles.

CONSTITUENT PARTS.

I. The Skin.

This membrane is pretty compact in its texture, and generally covered in man with numerous hairs ; it possesses, however, so much mobility, that it is possible to re-unite immediately the wound attended with a considerable loss of its substance. As its extensibility is not very great, it follows that, it is very difficult for abscesses and other collections to become prominent upon the fore part of the leg, and that they generally remain flattened ; so with other subcutaneous tumours. Its surface being scaly and more or less uneven, it is more exposed to the action of irritating causes, than if it was smooth and polished : therefore, it is frequently affected with erysipelas.

II. The Subcutaneous Layer.

This layer is generally of considerable thickness and arranged as upon the posterior part of the fore-arm ; it encloses but a small number of veins and nervous filaments, except at its most inferior part. Its deep lamellæ adhere but slightly to the aponeurosis ; so that, in amputations, it is very easy to dissect the skin if we think proper to do so, and this disposition also favours the approximation of the lips of its wounds, especially when the divisions are parallel to the axis of the limb. Placed between two pretty dense membranes, the aponeurosis

and skin, this layer easily inflames and may become the seat of phlegmons and abscesses; but the pus, pressed between these two membranes, extends and spreads with rapidity in all directions, and particularly downwards and upwards; for which reason these collections should be opened promptly, in order to prevent them from detaching the skin. Finally, as there are no vessels or nerves of importance in this layer, we may incise it freely without apprehension.

III. *The Aponeurosis.*

This lamina is strong, very distinct and tense; its fibres are principally oblique from above downwards and from the fibula towards the tibia; in its superior fifth it gives attachment to fleshy fibres; below, it is perforated by the anterior tibial and musculocutaneous nerves; in passing from the crest of the tibia, to which it is attached internally, towards the external part of the region, it does not send off any septum which dips between the muscles; only there are intermuscular cellular plates inserted into its posterior surface. It is fixed to the anterior border of the fibula in such a manner as to bind down the flexor muscles of the foot and to separate them from the lateral peronei muscles; it afterwards passes over the latter, and goes to attach itself to the posterior ridge of the same bone, forming for them a sheath, and separating them from the soleus muscle. In consequence of the strength of this aponeurosis and its unyielding nature, when deep seated inflammations are developed, it opposes the tumefaction of the tissues, and we are therefore obliged to divide it early, or prolong the incisions, when the inflammation manifests itself in consequence of a wound.

IV. *The Muscles.*

They are arranged in two orders; one, anterior, the other external. The first comprises, superiorly, the tibialis anticus and the extensor communis; the extensor proprius pollicis pedis, concealed between the two preceding, and the peroneus tertius (*péronier antérieur*), which does not always exist, and which we may consider as the external bundle of the extensor communis. These four muscles, imbricated upon one another from the tibia to-

wards the fibula, are firmly bound down in a canal formed, posteriorly, by the anterior interosseous fossa, that is to say by the external face of the tibia and the anterior aspect of the interosseous ligament and of the fibula; anteriorly, by the aponeurosis. The tibialis anticus is the largest of all, prismatic and fleshy in its superior half, and tendinous below, it then turns slightly inwards; it is separated from the extensor communis and extensor proprius pollicis by a cellulo-adipose septum, which cannot always be easily distinguished, but which is of great utility when we wish to tie the anterior tibial artery. In fact, in this operation, the incision must fall upon the interstice of these muscles in order to expose the artery. When we wish to discover it in the superior third of the leg, we may adopt one of several methods: first, by incising upon the middle of a line which would cross the region horizontally from the crest of the tibia to the fibula, or by making the incision one inch on the outer side of the tibia: or, by following a line dropped from the middle of the space which separates the head of the fibula from the anterior tubercle of the tibia upon the median part of the instep; or finally, by attentively seeking for the first interstice which presents itself, in proceeding from within outwards, after having divided the skin and the subcutaneous layer. Be this as it may, when we have entered the interval of these two muscles, if we penetrate with the finger perpendicularly to the plane of the region, we will easily separate them even as far as the interosseous ligament, because the cellular tissue which unites them is generally very supple, lamellated and affords but slight resistance. The other bundles present scarcely any interest in surgery. Those of the second order, or the external muscles, enveloped in their fibrous canal, remain for a long time applied upon the external surface of the fibula; but by degrees they incline with it backwards, and finally enter into the posterior region of the leg. As the peroneus longus and brevis (*péroniers lateraux*) are completely separated from the extensor of the toes and from all the muscles of the posterior region, by the two aponeurotic septa which fix themselves to the anterior and posterior borders of the bone, they may act independently of all the others. On the other hand, as they continue adherent as far as a little above the external malleolus, it thence results that their transverse section, in the two superior thirds of the leg, will not destroy their respective

actions upon the foot ; whilst lower down, it would be otherwise, for then the abduction of the foot would become almost impossible.

v. *The Arteries.*

The *Anterior Tibial* is the only one which deserves some attention : it is the first branch given off by the popliteal after it has traversed the fibrous arcade of the soleus ; it passes from the posterior to the anterior region of the leg through the superior part of the interosseous ligament, and in such a manner that it forms nearly a right angle with the trunk from which it originated. Having reached the interosseous ligament, between the extensor communis and tibialis anticus muscles, it thus descends to the inferior part of the region, parallel to the line which was indicated for the muscular interstice, and in such a manner that, if its origin makes a right angle with the popliteal, the anterior tibial portion, properly so called, makes another similar one with its horizontal part. This species of angular curvature, scarcely noticed by anatomists, has attracted the attention of M. Ribes, who thereby accounts for the very great retraction of the anterior tibial artery after the amputation of the leg. Throughout its whole course, this artery runs between two veins, and upon the interosseous ligament ; the nerve lies upon its external side above, upon its anterior surface in the middle, and upon its internal side below ; an extensible cellular sheath, possessing considerable resistance, unites all these parts ; so that it is not always easy to isolate the artery completely, in order to include it alone in the ligature which we wish to apply upon it. In order to discover this vessel, moreover, we are obliged to penetrate deeper in proportion to the height at which we endeavour to seize it. In order to expose it, by incising parallel to the internal margin of the tibialis anticus muscle, we must divide successively the skin, subcutaneous tissue and the aponeurosis, to the extent of three inches. The division of these three layers does not generally require much caution, because we run no risk of wounding any vessel ; but it is necessary that the incision through the aponeurosis should be extensive, in order that we may afterwards penetrate to the bottom of the interosseous space, between the mus-

cles indicated, which we separate by means of the finger or the extremity of a *sonde cannelée*. It is then especially, that we must flex the foot, as much as possible, in order to relax these muscles. It remains to raise the artery, and this is the most difficult step in the operation: 1st, on account of its depth; 2d, because frequently we can scarcely distinguish it from the veins and even from the nerve; 3d, because the artery being tense upon the interosseous ligament, we run the risk of breaking it, in endeavouring to raise it. In order to surmount these difficulties as much as is in the power of art, it is necessary to employ the *aiguille à manche* of Deschamps, or to give the end of the *sonde* a certain curvature; to pass it under the artery from without inwards, if in its superior half, on account of the interference which the prominence of the tibia would give if we acted in the opposite direction, and because it would be more easy to leave the nerve upon the outer side; if, on the contrary, we wish to secure the artery in its inferior half we must pass the instrument from the internal towards the external side, because the nerve is then on the inner side and the crest of the tibia has become rounded. In order to avoid stretching the artery, moreover, we should insinuate the director or needle under it very obliquely from below upwards instead of transversely. As, notwithstanding the means which we have indicated, it is not always easy to discover the muscular interstice, M. Lisfranc thinks that we will succeed more readily by dividing the skin, cellular layer and aponeurosis, in the direction of an oblique line which would pass from the crest of the tibia upon the anterior margin of the fibula two inches above its point of departure.* This surgeon also believes that the muscles can be much more easily separated by this process; as for us, we think that unless this incision is made much more obliquely, as we are informed M. Lisfranc does actually make it, we will experience much greater difficulties in attempting to raise this vessel than if the wound was parallel, because the longer the division the easier will it be to seize the artery; at least this is what we have always experienced in our performance of this operation upon the dead body. On the other hand it must be admitted that the spinous part of this liga-

* Taxil, these etc.; Coster *Manuel*, etc.

ture is not the point which relates to the muscular groove, which we always find by means of the indices which we have denoted.

The arterial branches given off by the anterior tibial are only muscular twigs, very numerous indeed, but of small volume: the *recurrens tibialis*, which ascends upon the external side of the patella, is the only one which deserves particular notice, and we have already pointed it out in the region of the knee.

VI. *The Veins.*

Those of the subcutaneous layer are, as we have before stated, very small; therefore varices are not commonly developed in the anterior tibial region; sometimes, however, they do occur in it, and not unfrequently ulcerate. There are also branches of the external saphena, and a few of the saphena interna. The deep-seated veins are two in number, running along both sides of the artery, upon a more anterior plane, and covered by the nerve: so that it is sometimes very difficult to avoid them in tying the anterior tibial artery; but their volume is so inconsiderable, that we might include them without danger in the loop of the ligature.

VII. *The Lymphatics.*

The superficial set consists of eight or ten principal trunks, which freely communicate with one another; trunks which receive a part of those of the sole and dorsum of the foot, and which pass along the inner side of the knee in order to enter the superficial glands of the groin; therefore, subcutaneous inflammations of the foot may be easily transmitted to the region of the leg on the one hand, whilst, on the other, diseases of the same layers, in the latter region, re-act forcibly upon the inguinal glands.

The deep-seated set follows the course of the blood-vessels, so that, in the sheath of the latter, it is always possible to find two or three lymphatic trunks. In consequence of this distribution we may presume that deep disorganizations of the fore part of the leg might produce tumefaction and alteration of the glands of the ham. We may also note that there is uniformly a lymphatic gland situated before the anterior tibial vessels, sometimes

higher, at other times lower, but always below the aperture in the interosseous ligament, through which these vessels pass into the popliteal region. We are not aware that this small organ has ever become so much enlarged as to form a distinct tumour; however, we conceive that it might become swollen, compress the vessels as well as the nerve, and thus occasion more or less grievous accidents.

VIII. *The Nerves.*

The external popliteal (*fibular*) nerve furnishes them all, but by two different branches, which result from the division of its trunk on the outer side of and below the head of the fibula. The first or musculo-cutaneous (*External Fibular*) nerve, descends with the peronei muscles, in their sheath, traverses their fibres and crosses them very obliquely from behind forwards, so as to become subcutaneous, about three or four inches above the instep, where it divides in its turn into two branches: wherefore when superficial tumours exist in the inferior fourth of the leg, or when incisions are made into it, this nerve may be stretched or divided, whilst, in the three superior fourths of the region, it could not be injured unless by a wound which would comprise at the same time the aponeurosis and one of the peronei muscles; still this could only happen upon the external border of the limb, for all of the anterior part is completely free from nervous filaments. It must be observed, however, that in certain subjects, we there observe some filaments of the internal saphenus nerve.

The second branch, or the anterior tibial nerve, after having crossed the external and anterior aspects of the fibula, behind the origin of the peroneus longus and extensor communis, places itself upon the external side of the vessels, in such a manner as to approximate them insensibly in descending, and to cross very obliquely their anterior face, in order to apply itself upon their internal side, before it gets below. We have already said, when speaking of the ligature of the artery, that it was important to notice this course in relation to this operation; it is also well to recollect it after the amputation of the leg, when we tie the anterior tibial artery.

IX. *The Skeleton.*

It comprises all that portion of the external face of the tibia which is found before the interosseous ligament, and the corresponding portion of the internal surface of the fibula; and as these two bones are united by means of the interosseous membrane, they form an elongated fossa which is converted into a canal by the aponeurosis; a fossa which is broader and deeper at the union of its two superior thirds, where the tibia is turned inwards and the fibula outwards, than at their two extremities. The muscles are wedged as it were, into this fossa; from which circumstance they are not easily incised, but are rather mashed in circular amputations, and the depth of the excavation renders it difficult to form a flap, from the bones towards the skin. We will give this subject some further consideration after we have examined the two other regions of the leg. Let us merely observe, that in order to arrive at the bones or the interosseous membrane, it will be necessary to penetrate through, 1st, the skin; 2d, the subcutaneous layer; 3d, the aponeurosis; 4th, the tibialis anticus, extensor longus communis, peroneus longus, and also the extensor proprius pollicis pedis, peroneus tertius, and peroneus brevis, if it is at the inferior part; 5th, between all these muscles, some fine and adipose cellular tissue, the nerves and vessels; 6th, the external face of the tibia, the anterior surface of the interosseous ligament and the internal of the fibula; finally, the external aspect of the latter bone.

Sect. 2. Posterior Region of the Leg.

This region is limited externally by the preceding, internally by the inner border of the tibia, and is much broader than that which has just been studied; it comprises all the soft parts which exist behind the bones of the leg, includes the double prominence of the calf, that of the tendo Achilles, and the two *tibio* and *peroneo-calcien* grooves. It is usually more uneven and dry in man than in woman; which is owing to the greater predominance of cellular tissue in the latter sex.

CONSTITUENT PARTS.

I. *The Skin.*

It is more delicate, extensible and sleek, generally contains fewer follicles, and is covered with a smaller quantity of hairs than in the anterior region; whence it follows that tumours and collections of every kind are developed in it with greater facility; that, in operations, we may excise it more extensively, and that its wounds, whether longitudinal or transverse, are more easy to unite immediately. It very frequently presents those streaks (*vergetures*) already several times noticed in other regions, and frequently slight eminences or divers reliefs, which are owing to the presence of the sub-cutaneous veins. As it receives a great number of vessels, it is very subject to different cutaneous inflammations.

II. *The Subcutaneous Stratum.*

This layer, similarly disposed to that of the palmar surface of the fore-arm, includes numerous superficial veins, and especially the trunks of the two saphenæ, together with the two nerves of the same name. Being lamellated rather than filamentous, lodging in the interval of its sheets many adipose vesicles, supple besides, and not adhering very intimately to the aponeurosis or the skin, it is well calculated for the formation of abscesses, which may easily extend from one point of this region to another and even enter it from the popliteal region; a disposition which indicates that these abscesses or collections should be opened early, if we wish to prevent the teguments from being extensively detached, and which permits us, in circular amputations, to raise the skin with great facility.

III. *The Aponeurosis.*

It is only the continuation of that of the ham, but which is arranged in a different manner; we may consider it as formed

of two principal sheets; one superficial. the other deep-seated. Both are fixed to the posterior margin of the fibula externally, and to the internal border of the tibia internally; the first seems to arise particularly from the *pes anserinus*, is spread over the posterior surface of the muscles of the calf and tendo Achillis, and is lost, below, in the fibro-cellular tissue which surrounds the heel. Its laminæ split in order to form a sheath for the external saphena vein in the superior half of the region; and so likewise for the branches of origin of the corresponding nerve. As for the rest, this sheet is neither very strong nor very dense; it possesses a certain extensibility, and consequently readily permits deep abscesses to become superficial; for the same reason it does not embarrass us so much in operations, nor produce such serious compression in inflammations, as the aponeurosis of the anterior region.

The second sheet continues the aponeurosis of the popliteus muscle, and descends between the two muscular strata, but in such a manner as to divide into two laminæ at the place where the soleus muscle detaches itself from the deep parts. One of these laminæ follows the anterior surface of the tendo Achillis, and together with the superficial sheet, which is spread over this tendon behind, forms for it a complete fibrous canal; the other remains applied upon the posterior face of the deep muscles, and both extend as far as the os calcis; so that the aponeurosis of the leg, in its inferior third, circumscribes three distinct spaces: one, which is filled by the tendon of the muscles of the ham; the second, which encloses the flexor muscles of the toes and the vessels; and lastly, the third, which separates the two others, is found situated between the tendo Achillis and the posterior surface of the muscles last mentioned; the latter is remarkable for its being filled with fat, and very dense fibrous filaments which intersect each other in various directions. From this disposition, it is evident that four kinds of abscesses may form here; three in the different sheaths just mentioned, and the fourth in the subcutaneous tissue.

IV. *The Muscles.*

We have just seen that they are arranged in two distinct strata: one which comprises all the muscles of the calf and their tendon; the other, the deep muscles of the leg.

In the former the gemelli and soleus, at first separated by a cellular lamina, terminate in becoming confounded by their tendons; the fleshy portion of the former ceasing above the middle of the leg, that of the second only continues to descend as far as the interior third of the limb, deriving its points of origin from the posterior surface of the tibia, below the popliteus muscle, and from that of the fibula, below the head of this bone; or rather, its fibres departing from the deep sheet of the aponeurosis, in the middle part of the leg, it is disposed in such a manner, that, in order to find the posterior tibial artery, for example, it would be necessary to divide its internal portion and the fibrous sheet to which it is attached. The fleshy mass of these muscles is composed of a considerable quantity of fibres, but of short fibres; whence it results, that, although their combined action is very powerful, yet they cannot produce very extensive movements; thus, they easily remove the heel from the ground in raising the weight of the body, whilst they cannot carry very far the extension of the feet and can assist but little in flexing the leg. Their power is so very great, that they have, more than once, been known to rupture the tendo Achillis, in a violent effort to maintain the equilibrium of the body when in the act of falling. This rupture, to which A. Paré and J. L. Petit first directed the attention, is so serious an accident that we consider it proper to dwell a moment upon the anatomical disposition of this tendon.

Being composed of three parts, it has been supposed that each of them might be ruptured separately, and hence those distinctions about which there has been so many disputes, and which are not even yet reconciled. The portion which appertains to the gemelli is at first thin and broad, but afterwards becomes narrow and thick in the same proportion, before it becomes intimately blended about three fingers breadth above the malleoli with that of the solæus, which is of much greater strength and magnitude. From this disposition, we see that, if it is easy to comprehend

the possibility of the distinct rupture of the tendon of the gemelli previous to its union with that of the solæus, we must at least admit that the cases related by Petit, Delamotte, etc. are far from proving its existence, which, on the other hand, has never been demonstrated by autopsic examination.

The third portion is merely the tendon of the plantaris, which descends obliquely inwards upon the anterior surface of the gemelli and is attached to the internal border of the tendo Achillis. Although slender and of a remarkable length, its strength and its resistance are such, that it is not so easy to comprehend how its rupture can take place, as seems to have been generally imagined. In fact, the authors of animal mechanics have remarked that it is capable of sustaining a weight of five hundred pounds. Now, the contractions of the single muscle which can act upon it are certainly insufficient to raise a similar weight; besides the sensation, as if a blow was given with a stick upon the calf, which some persons experience during a great effort, the pain and ecchymosis which follow, might be quite as well accounted for by the rupture of some of the muscular fibres as by that of the tendon in question. Finally, the depression which has been considered as a pathognomonic sign is not a sufficient proof; for admitting this rupture, to what depression could it give rise? Is not this tendon too slender to occasion any alteration in the form of the leg even if it should be lacerated? Thus, without denying the possibility, or the existence, of this rupture, in some of the cases related as such, it seems to us that no observation has incontestibly proved it. We are far from believing with Sabatier, for example, that the case related by Paré as a rupture of the tendo Achillis, was rather a laceration of the plantaris, neither will we admit, with Petit, that it was an incomplete rupture of the great tendon of the leg; and since there was a depression of considerable depth above the heel, if it was necessary to form an opinion upon this case, we would by far prefer adopting that of the patriarch of French surgery. There is nothing then satisfactorily proved, by all these facts, but the complete rupture of the tendo Achillis; and as this cord continues to receive fleshy fibres from the solæus almost as far as the heel, it follows that this laceration is scarcely possible except at the lowermost part of the leg. It is important to remark, on this occasion, that the *tibio*-and *peroneo-calcien* gut-

ters are very deep in this place, in order that we may fill them exactly, as authors direct us, with graduated compresses, lint or other substances, at the same time that we elevate the heel very considerably and flex the leg; but it is also necessary to note that, when the foot is forcibly extended, the aponeurosis draws the tendo Achillis against the posterior surface of the deep-seated muscles, and that then the application of the compresses above mentioned becomes totally useless; so that a simple roller bandage will give the same result, whether there are lateral compresses or not.

Finally, let us observe that this tendon is so prominent behind, that a cutting instrument may divide it completely, without touching either the principal vessels or nerves: besides, its re-union will then be obtained by the same means as in cases of its simple rupture.

The deep muscles, which are bound down in the posterior interosseous fossa by the intermuscular sheet of the aponeurosis, are: behind the tibia, the tibialis posticus, upon the posterior surface of which the posterior tibial vessels and nerves are applied; behind the fibula, the flexor longus pollicis pedis, and, upon the posterior aspect of the interosseous ligament, the flexor longus digitorum pedis; so that the latter lies a little deeper than the two others, and is covered by a fibrous expansion which is confounded as it descends with the deep aponeurosis. The space which these muscles fill, diminishing in breadth in proportion as it becomes more inferior, they are obliged to approximate one other in proceeding towards the malleolus internus; but we will again see them in this point.

v. *The Arteries.*

They are all derived from the termination of the popliteal: the first, or the *anterior tibial*, after running a few lines, traverses the interosseous ligament, and sometimes separates from the trunk before the latter has entered under the arcade of the soleus muscle; but, more frequently, it does not come off from it until it gets below the popliteus muscle, and in this case, we conceive that, if the leg was amputated very high up, we might only find it necessary to secure a single arterial trunk. After the popliteal

has given off the anterior tibial it still descends about the space of an inch, and sometimes even more, before it bifurcates; then it is upon the anterior surface of the aponeurotic origin of the soleus; more frequently, also, the nutritious artery of the tibia separates from it during this part of its course, in order to enter into the groove which appertains to it in this bone, previous to its entrance into its canal; so that if the limb is removed on a level with the inferior margin of the popliteus muscle, we would have to apply at least three ligatures; one upon the popliteal, another upon the anterior tibial, and the third upon the nutritious artery of the bone. Thus far, we must remark, that the nerve is on the inner side of the artery, and that the latter is enveloped, as it were, by its two collateral veins: of the two branches which terminate it, the *posterior tibial* is the largest and most important, and appears to be the real continuation of the trunk.

As the posterior tibial directs its course towards the internal border of the tibia, it is very slightly oblique. Its most superior portion corresponds, in fact, to the middle of the interosseous space, then, by degrees, to the point of union of the flexor longus digitorum and tibialis posticus muscles; finally, to the posterior surface of the latter. Its two venæ comites are situated behind and upon its sides, without adhering to it very firmly. The nerve of the same name, which is found on the inner side of the popliteal artery, crosses the superior and posterior part of the posterior tibial artery, afterwards descends upon its internal side, and at length, when it arrives at the lower part of the region, is replaced behind it. According to these relations it is evident that there must be a difference in the application of a ligature around the posterior tibial artery in the two principal points at which we wish to practise it. For example, if we endeavour to expose this vessel towards the union of the superior with the middle third of the leg, by making an incision three or four inches long, about half an inch or an inch behind the internal border of the tibia, and parallel to the direction of the limb, we will not reach it until after having divided, 1st, the skin, under which we sometimes find the internal saphena vein and the internal saphenus nerve, which must be pushed backwards or forwards, according as it may appear most easy; 2d, the superficial sheet of the aponeurosis, upon the line of separation between the internal portion

of the gemellus and soleus, so as to fall upon the fleshy mass of the latter, the fibres of which we cut until we distinguish the thick aponeurosis upon which they are fixed : then by dividing, in its turn, this fibrous sheet to the extent of several inches, and at the distance of half an inch on the outer side of its attachment to the internal border of the tibia, we may be sure that the artery is not far off ; this incision should be very cautiously made in order to avoid wounding the vessel with the same stroke of the bistoury ; indeed, it is best to make at first only a simple puncture with the point of the instrument, and afterwards introduce into it the extremity of a grooved director, upon which we may enlarge the opening without apprehension ; then by pushing the external lip of the wound backwards and outwards, we will uniformly meet with the artery between its venæ comites, in the lamellated and adipose layer of cellular tissue which separates the tibialis posticus muscle from the anterior aponeurosis of the soleus, and we perceive upon its external side the posterior tibial nerve. Consequently, we may affirm that upon the dead body the application of this ligature is not very difficult, and that the important point consists in falling upon the deep aponeurosis. We constantly reach it, and in a safe manner, by cautiously dividing the tibial portion of the soleus muscle, in the direction of a line which would pass from the incision in the skin towards the external border of the tibia. But it appears that, upon the living subject, we meet with difficulties of a different nature. In fact, if the patient is strong, the muscles of the calf contract with violence, and it frequently becomes impossible to separate the external and posterior lip of the wound ; therefore M. Boucher, of Lyons, was obliged, in a case of this kind, to divide these muscles transversely, giving to the wound the figure of a Γ . It is needless to say that, during this operation, the leg must be flexed, on account of the gemelli muscles, and the foot extended, on account of the soleus.

In order to tie this artery in the inferior third of the region, and especially at two inches above the malleolus internus, if we recollect the exact arrangement of the parts, the operation will always be more easy and safer than elsewhere. It is sufficient, in fact, in order to arrive at this vessel, to measure the space which separates the internal border of the tibia from the tendo

Achillis, and to incise upon the middle of this line: then, we meet with the skin, the subcutaneous layer, next, the posterior sheet of the aponeurosis, previous to falling into the celluloadipose layer, which separates the tendo Achillis from the deep muscles; afterwards, we have only to divide the fibrous sheet which binds down these muscles, when the artery will be exposed in the space between the tibialis posticus, which is on the inner side, the flexor longus pollicis which is on the outer side, and the flexor communis digitorum, upon which it rests. The collateral veins sometimes completely obscure it, and the nerve is also situated behind it; so that, if we distinguish one of these organs through the fascia, we may be assured that the artery is only a few lines, at most, before and within it. But, if it is easy to succeed by proceeding in this manner, we must be well convinced, on the other hand, that if we deviate from these directions, we run the risk of being led astray in two different ways: thus, if the incision is made too near the tendo Achillis, we open the sheath which encloses it, and become lost in the cellular tissue, without finding the artery: if, on the contrary, this incision is carried too close to the tibia, we only meet with one fibrous sheet before we come to the muscles, and nothing is then more easy than to wander among them. Finally, it is evident that, if we endeavour to reach the artery by dividing the muscles of the calf directly from behind forwards, as has been done by Guthrie, the difficulties would be still greater than by the process mentioned above, and we will see presently that the ligature above the malleolus is preferable to that which we are recommended to make behind this eminence.

The second branch of termination of the popliteal or the *peroneal* (fibular) artery diverges slightly from the preceding, and descends, applied upon the posterior surface of the fibula, between the flexor longus pollicis and the flexor digitorum communis muscles. Coasted by two collateral veins, and separated from the posterior tibial artery by the nerve of the same name, and especially by some muscular fibres of the flexor longus pollicis, this artery not proceeding as far as the foot, and its depth being considerable, it thence follows that its wounds are neither frequent nor alarming: therefore has its ligature been but little spoken of, which, besides would be very difficult, and could not

actually be accomplished in the middle of the leg but in seeking for it by the external side of this member. Then we would have to divide the same parts as for the posterior tibial, but on the opposite side, and as the artery is enveloped in the fibres of the flexor pollicis longus, it would also be necessary to detach this muscle from the fibula: yet, notwithstanding, it frequently happens that it will be difficult to find the vessel. Below, it is so small, and, moreover, lies so deep, that we never attempt to apply a ligature upon it.

Lastly, the *surales* are also two branches which should be noticed in the posterior tibial region, because they often require distinct ligatures after amputation.

VI. *The Veins.*

The superficial veins are the most important in this region, and in no other region of the body do they afford more interest in a surgical point of view: all of them empty into the trunks of the two saphenæ. The internal saphena enters the posterior region of the leg a few inches above the malleolus, runs along the internal border of the calf, and passes through the superior narrow portion of the limb in order to enter the knee, precisely in the fossa, in which we are in the habit of establishing a drain. As it receives a great number of branches, is very remote from the heart, and continually obliged to propel its contents contrary to the laws of hydraulics, on account of its dependent position, it is by no means astonishing, notwithstanding its numerous valves, that of all the veins of the body it is most frequently affected with varices: therefore ulcers consequent upon this state of the vessels, are generally more frequent upon the inner side of the leg, than in the other portions of this extremity. It is well known that in pregnant women, and especially in men of a dark complexion, and those who are constantly in an erect posture, pursuing a laborious occupation, such as printers, for example, these veins sometimes acquire an enormous volume, intersect each other in various directions, constituting more or less complicated plexus, and that in these cases, wounds of the legs, although very superficial, sometimes produce a very abundant hæmorrhage. Every one knows, also, that these varices give

rise to a great many diseases, and that the means of removing them consists in the proper application of bandages. But, as this is only a palliative treatment, other means have been proposed for their radical cure, and on this account, particularly, it is necessary to know exactly the anatomical relations of the vena saphena interna. Therefore, whether we content ourselves with tying it in the upper part of the calf without dividing it, or, on the contrary, divide it between two threads, in order to remove a portion of it, or cauterize the varicose tumours, or excise them, or make long and deep incisions upon the principal dilated trunks, after the manner of M. Richerand, and some other surgeons, it must never be forgotten that, if the vessels, as is the fact, are situated between the aponeurosis and skin, and that no organ of the first rank is in their immediate neighbourhood, still, it is not the less true, on the other hand, that the internal saphenus nerve and its filaments are always applied to the trunk or branches of the vein; so that in the operation just mentioned, it is, generally, impossible to avoid them, and this perhaps may be one cause of the dangers which too frequently accompany the ligature of the veins, because, then, it is only more or less incompletely strangulated, whereas, in the other processes, it is entirely divided.

The external saphena runs through the whole length of the region; it ascends, following a more or less oblique and tortuous direction, from the peroneo-calcien gutter, upon the posterior surface of the external gemellus, in order to dive into the ham, as we have before seen. Inferiorly, it is, as well as the preceding, enveloped in the laminæ of the subcutaneous cellular layer; but it soon penetrates between the sheets of the aponeurosis, so that from its depth superiorly, it is not exposed to compression by the garters; which, together with its supporting a smaller column of blood, partly accounts for this vein being less frequently affected with varices than the internal. As in like manner with the latter, it is accompanied by a large nerve, it requires in its inferior third the same surgical attention; and besides, as we sometimes bleed from it in the malleolar gutter, we must recollect that there especially, the nerve lies very close to it, but that on the other hand, there is no other important organ to avoid. This disposition of the vena saphena externa (*péronéo-malleolaire*, Ch.) explains why the external part of the calf is so seldom affected

with varices, whilst the external and inferior part of the leg is as frequently the seat of them as the corresponding internal portion, and also accounts for the more frequent developement of ulcers in the vicinity of the fibular malleolus.

The deep veins follow the arteries and were pointed out when speaking of the latter ; we must note, however, that they are distributed in pairs, and enveloped in the same sheath with the artery ; from which circumstance, when we attempt to tie the latter it is somewhat difficult to separate them.

VII. *The Lymphatics.*

Those of the superficial layer are very numerous ; they receive all the branches of the sole of the foot, and run through the popliteal space to their termination of the inner side of the thigh. Those of the deep parts follow the course of the blood-vessels and pass into the glands of the ham ; therefore diseases of the subcutaneous cellular layer will re-act upon the inguinal glands, whilst those which have their seat under the aponeurosis, will transmit their influence to the lymphatic ganglions of the popliteal space.

VIII. *The Nerves.*

Like the veins and lymphatics, the nerves are superficial and deep-seated. The two sapheni compose the first order ; the external arising, as we know, by two roots from the external and internal popliteal nerves does not place itself completely by the side of the vein until near the inferior third of the leg : it is also situated, in the same manner as the internal, sometimes before, at other times behind the vessel, the distribution of which it follows so exactly that it is needless to dwell upon it. The only attention which these nerves exact during operations, is to avoid pricking, partially dividing or stretching them in any manner whatsoever.

The posterior tibial nerve, with the exception of some branches which it gives off, is the only one which appertains to the second order ; situated between the two principal arteries, it more especially follows the posterior tibial, and in such a manner that it is found almost directly behind it in the lower portion of the leg.

It is the continuation of the internal popliteal (tibial); is very large, and as it runs between the muscular strata, it is so deeply situated that it is with difficulty wounded; but from its relations with the artery which it accompanies, it may when we attempt to secure this vessel, in consequence of its division or an aneurism, be easily injured or even included in the ligature instead of the artery, if we do not use all necessary caution. On the other hand, it also serves as a guide in these operations, because it may readily be distinguished on account of its volume; and when we have discovered it, we can readily find the vessel which we are in search of; it is important, however, to avoid it, for as it is almost the only nerve which supplies the sole of the foot, its lesion might occasion paralysis of this part of the limb. After amputation it must equally be excluded from the ligature which must embrace one of the arteries, if we do not wish to lay the foundation for nervous accidents.

IX. *The Skeleton.*

It consists of the posterior aspect of the bones of the leg and of the interosseous ligament, and forms a gutter or fossa which is broader than that of the anterior region, but more superficial, except below, where the faces of the fibula and tibia are very much elevated as they approximate each other. In consequence of this disposition, the deep-seated muscles, although applied upon a broader surface than those of the anterior region, without being more voluminous, nevertheless project much more beyond the level of the interosseous fossa posteriorly, whereas the anterior muscles are completely included in their particular fossa; so that it is generally very easy to form a thick flap in the posterior region, when we amputate the leg. But then it should not be forgotten that the fibula is found upon a plane posterior to that which the tibia occupies, and that the interosseous ligament leaves behind, the external border and about the posterior half of the corresponding face of this bone.

In the full grown fœtus the tibia presents but a very slight curvature; but, this curvature increases with age, and in the adult it is sometimes very considerable; so that it appears to depend upon the pressure made upon this bone by the resistance of the

ground and the weight of the body, having a tendency to bend it forwards, and this mechanical explanation is also strengthened by what occurs in most rachitic individuals. In fact, the bow-leg in the greater number of these persons, is only an augmentation of the natural curvature of the tibia. It may be objected, however, that many rickety children who have never walked have their legs very much bent; but there is another cause equally mechanical, which fully explains this peculiarity. We have, in fact, just seen that the posterior muscles of the leg are much more numerous and powerful than those of the anterior; therefore, it is quite plain that the former acting upon the flexible bones, to a certain point, will finally predominate over the latter, and thereby increase more or less the natural curvature of the tibia.

Let us also remark that, in consequence of this disposition, when fractures occur, especially from an indirect cause, the angle made by the two fragments, when there is displacement, is almost always forwards, and that the limb then has a tendency to bend at the fractured part; it also follows that these fractures may be easily produced by a direct cause, when the posterior surface of the leg rests horizontally upon a solid plane, because the tibia, bearing only upon its two extremities, will break in a point of its body, before the super-incumbent weight can have straightened its curvature. But we will have occasion to recur to the mechanism of fractures and the subject of amputations, after having studied the internal region; before, however, we abandon this, let us point out the order of superposition of the different organs which compose it.

(*a*) In the superior half we find, 1st, the skin; 2d, the sub-cutaneous layer, containing fat in greater or less abundance, the internal saphena vein, the nerve of the same name, and several of their branches; 3d, the posterior sheet of the aponeurosis, including in its laminæ the external saphena vein and the roots of the nervus communicans tibialis (*nerf homonyme*); 4th, a muscular plane, formed by the gemelli and plantaris muscles, in which we find the arteriæ surales and some filaments of the posterior tibial nerve; 5th, a second fleshy plane, formed by the soleus muscle, supported by a very thick and very strong fascia; 6th, the deep sheet of the aponeurosis, blended, in part, with the preceding, and which separates the muscles of the calf, properly so called, from

those of the interosseous fossa; 7th, upon another plane, and from the internal towards the external part, the tibialis posticus muscle, the tibial vessels and nerve, the flexor longus pollicis muscle, and the fibular vessels imbedded in its fibres; 8th, lastly, the tibia internally, the fibula externally, and, in the middle, the flexor longus digitorum and the interosseous membrane.

(b) In the inferior half we meet with, 1st, the skin, much thicker than above; 2d, the subcutaneous layer which is generally thinner directly behind, but of equal thickness at the sides: in the supra-malleolar grooves it contains several venous branches which go to empty into the internal saphena, and the external which is enveloped in its deep laminæ; 3d, a superficial sheet of the aponeurosis, with transverse and semi-circular fibres, leaving spaces between them, which are usually traversed by corpuscles of adipo-cellular tissue, and by means of which inflammation of the superficial cellular layer may be transmitted to the sheath of the tendo Achillis; 4th, the tendo Achillis, the rupture of which, from its volume, might be considered as impossible, if J. L. Petit and Sabatier had not seen that of the ligament of the patella, and if the former had not detailed three cases which prove that the very strong tendon of the extensors of the leg, may equally be broken; 5th, a second fibrous sheet which completes, posteriorly, the sheath of the preceding tendon; 6th, a filamentous and adipose cellular layer, thicker below than above, and separating the aponeurotic sheet just mentioned from the interosseous canal; 7th, a third fibrous expansion, or the deep-seated sheet of the aponeurosis, which converts the interosseous fossa into a canal; 8th, the posterior tibial nerve, veins and artery, the tibialis posticus muscle and the flexor longus pollicis pedis; then, between these two muscles, the flexor longus digitorum; 9th, lastly, the posterior faces of the tibia and fibula, very much rounded, as well as the deep groove which separates these two bones, and in the bottom of which we see the fibular artery.

Sect. 3. Internal or Tibial Region of the Leg.

This region is formed by the parts which lie upon the internal face of the tibia, is convex like this bone, and pretty distinct superiorly; inferiorly, on the contrary, it is lost, so to say, in the anterior and posterior regions.

CONSTITUENT PARTS.

I. *The Skin.*

Like that of the anterior region, it is covered with hairs and includes numerous sebaceous follicles, it is thicker, however, and of a more compact texture ; therefore, in its wounds, with loss of substance, it is generally very difficult to obtain an immediate re-union ; and may not this be one of the causes which render cicatrization of ulcers upon the fore part of the tibia so tedious ? On the other hand, as this membrane does not rest upon parts susceptible of retraction, it follows that, in amputating, according to the circular method, by the process of J. L. Petit, we are obliged to dissect it up to a very great extent, so as to be able to raise it to a level with that of the posterior region, for example ; and as it is supported by the bones only, it may remain pendent and mortify after the operation. It was with the intent of avoiding this inconvenience, that Sabatier and some others recommended incising the teguments of the tibial region some lines higher than in the rest of the circumference of the limb ; but this advice has not been followed, and we do not see that the fears of this surgeon were correctly founded.

II. *The Subcutaneous Layer.*

Thinner and enclosing a greater quantity of adipose vesicles than that of the preceding regions ; composed of laminæ and filaments, which intersect each other so as to form a dense and very close tissue, uniting the teguments somewhat solidly to the periosteum, this layer with difficulty permits fluids to collect in a circumscribed cavity, or at least, when abscesses do form in it, the collection is necessarily very limited, and burrowing is almost impossible ; it is the same with tumours which are occasionally developed in it ; it includes, besides, all the vessels and nerves of the region.

III. *The Aponeurosis.*

The aponeurosis of the leg, fixing itself upon the anterior and internal borders of the tibia, is not distinguished upon the inner surface of this bone, or rather, it is there found blended with the periosteum.

IV. *The Muscles.*

They are wanting in this region, excepting the expansion called *pes anserinus*, which covers its uppermost part; which renders wounds more dangerous at this point, and should induce surgeons to avoid operating upon it without absolute necessity.

V. *The Arteries.*

These are only some capillary ramifications of the branches already examined. The malleolaris interna, derived from the anterior tibial, is the only one which merits attention, and merely in those subjects in whom it is very voluminous; in no case, however, can it occasion a dangerous hæmorrhage; and, on this account, we may perform all kinds of operations or incisions upon the fore part of the tibia, without fear of being stopped by the loss of blood.

VI. *The Veins.*

We only find here the trunk of the saphena interna and some of its roots; still does it only exist in the inferior third of the region; but, in no part does it present greater interest. Enveloped in the deep laminæ of the subcutaneous layer, it is separated from the tibia by the periosteum only, and as this disposition does not vary, be the embonpoint of the individual what it may, it follows that in fat persons the saphena appears very deep, whilst in those who are thin, it seems much more superficial; for which reason it is generally much more difficult to perform venesection in the foot of the female than in the male. Sometimes this vein remains situated between the integuments and the bone

as high as the knee ; but generally it gains the tibio-calcien groove, even before it reaches the middle of the leg. Although these varieties are apparently of but little importance, they are worthy of attention, however, when we are about to draw blood from the foot. For, in the first case, the bandage, whether applied above or below the calf, will compress the vein with equal efficacy, since the point of support presents the same solidity superiorly as inferiorly ; in the second, on the contrary, it would be better to apply it a few inches above the malleoli, because, in the superior part, the vessel being supported by the muscles only, or, what amounts to the same, by the aponeurosis, its obliteration will not be so certain or complete. Further, with respect to this operation, we may incise in every direction, and even to the bone without danger ; the only organ which it would be well to avoid, if the thing was possible, is the saphenus internus nerve ; but as its position varies, being sometimes before and sometimes behind the vessel, we cannot point out any general rule for avoiding it, unless it is that of puncturing the vein parallel to its length. This method of acting, which at first sight appears somewhat difficult, is, in fact, much less so than might be supposed ; and we may, with a little dexterity, easily accomplish it, provided we fix the vein exactly between the thumb and the ligature ; by proceeding thus, we not only avoid the nerve, which is almost always partially or completely divided when the incision is made obliquely or transversely, but we also obtain thereby a larger opening in the vein, without making that of the skin more extensive ; so that, when the puncture is well made, the blood spirts out in an arched manner, as it does when bleeding from the arm. We might affirm, from our own observations, and those of M. Jebert, who pointed out this circumstance to us in 1822, at the Hospital of St. Louis, that by this method we obtain a distinct and somewhat forcible jet, so that the blood may be caught in a bowl ; whereas, by the other methods this fluid only dribbles out, or flows in a slow and very irregular manner. This remark, which may appear rather trifling to some, is actually of considerable importance in practice. With respect to the accidents which are attributed to the pricking of the periosteum, it seems to us much more natural to refer them to the lesion of the nerve ; so that the only risk we incur by plunging the instrument down to the bone

is that of breaking the point of the lancet, in which case a small abscess may result, attended with more or less acute pain; besides, as the skin is thick and tough at this point it is even advantageous to penetrate more than less, if we do not wish to fail opening the vein, which is very moveable and apt to roll.

It is above the malleolus internus that varices most frequently commence; which is doubtless owing to the size which the saphena has already acquired, and its being destitute of that assistance which the muscles afford to its circulation; it is likewise in this place that we most usually find those *sordid, Théléphien, Chironien, callous, varicose, etc.* ulcers, which are so difficult to cicatrize, and not always to be healed without danger.

VII. *The Lymphatics.*

They are comprised in one layer, and creep in the subcutaneous cellular tissue in their course towards the anterior and posterior regions.

VIII. *The Nerves.*

The saphenus internus is the only one worthy of notice, and we gave a sufficiently minute description of it when speaking of the vein.

IX. *The Skeleton.*

This is constituted by the internal surface of the tibia, and in some subjects naturally presents, near its middle, a very strongly marked convexity, which might be mistaken for an extosis, if we were not aware of this circumstance. It is covered by a very thick and very vascular periosteum, which is not sufficient, however, to explain the frequency of exostoses upon the tibia. As it is covered only by the skin and the subcutaneous tissue, it is almost always possible to feel it from the surface, appreciate its deformities and detect its fractures; and for the same reason it is very much exposed to contusions, jars, and other injuries produced by the action of external agents. When ulcers exist, it is not very unusual for it at length to participate in the disease, and

it sometimes becomes softened, carious, or dead under these solutions of continuity, when they have lasted for a considerable period. As the two borders of this surface of the tibia are always sub-cutaneous and readily felt, it follows that by tracing them we can always ascertain, without difficulty, the slightest displacement of the fractures of this bone. But let us now examine the skeleton of the leg in general.

With respect to fractures, it is well to note that the two bones may be broken together, or separately, and that, if the tibia, notwithstanding its volume, is as frequently broken as the fibula, and even more so, it is because it receives alone the whole weight of the body, and transmits it to the foot, whereas the other has scarcely any effort to support. When it is broken singly, the fracture is generally transverse, a circumstance which opposes the displacement, according to the length, and often even according to the thickness and the direction. Therefore rest and any bandage whatever are sufficient in order to obtain an exact consolidation; and more especially, as nothing will then tend to diminish the interosseous space, because the muscles, instead of drawing the tibia outwards, will be more likely to pull it inwards. This fracture may take place in any part of the bone; but it is evident, from its figure, curvature and dimensions, that it will break more easily towards the point of union of its inferior with the middle third than elsewhere.

As the fibula is directed outwards and a little backwards, and does not rest upon the foot, it seems only to be intended for multiplying the surfaces for muscular insertions; therefore it happens, in certain cases, that, notwithstanding it is fractured, patients are still capable of supporting themselves in the erect posture, of walking even, and Desault thought that its middle portion might be removed without rendering progression impossible. It is, especially, when broken in its superior half, that this solution of continuity is not attended with displacement, because the fragments are then supported by the muscles; but this fracture more frequently occurs a few inches above the malleolus than in any other point, because the bone is already curved inwards, towards this point, which is, besides, the weakest, and especially because the most common cause of this accident being a violent twisting of the foot inwards or outwards, the fibula must yield and break in the

least elevated and most slender portion. In order to distinguish this fracture and avoid being imposed upon by a simple contusion, we must recollect that the anterior surface of this bone, having become external, is naked under the skin, until about three inches above the external malleolus, that is to say, as far as the point where the peroneus longus and tertius muscles, separating from the peroneus brevis, incline backwards; and that the skin being more adherent here than behind, before and above, a depression of greater or less depth results, when a tumefaction supervenes in the outer and inferior part of the leg in consequence of a fall, a blow, or any other violence capable of fracturing the fibula, whether this fracture exists or not. Consequently, the sign known by the name of *hatchet-stroke* (*coup de hache*) must not be considered as a certain proof that the fibula is fractured, unless there is at the same time a more or less extensive ecchymosis; neither should we affirm it, until we have recognised a crepitus by the ordinary means, or by the stethoscope. In this fracture, the action of the peroneus longus and tertius muscles, on the one part, and the effort which the foot makes to turn itself outwards, on the other, oblige the two fragments to approximate the tibia, so as to close completely the interosseous space: so that in order to obtain an exact coaptation and consolidation, it is sufficient to oppose this transverse displacement. We fulfil this double indication by means of the ordinary apparatus for fractures of the leg, only taking care to give greater length to the external splint, in order to be able to place between it and the os calcis sufficient padding to overcome the eversion of the foot; but we fulfil this indication, in a still more certain manner, by the use of the bandage proposed by M. Dupuytren, that is to say, by drawing the foot inwards, in order to fix it upon a long internal splint, the inferior extremity of which is removed from the tibial side of the leg by a cushion which increases in thickness in proportion to its proximity to the malleolus. In all cases, it seems better to keep the muscles relaxed by placing the leg upon its outer side.

When both bones are fractured, in any point of their extent, the displacement is never very considerable, unless the fracturing cause has continued to act after the solution of continuity: which appears to be owing principally to the muscles deriving their ori-

gins from the whole extent of the osseous surfaces. It is then most frequently observed, that the superior fragment of the tibia represents a sloping cut upon its external and posterior surfaces, so that its pointed extremity projects more or less the integuments which cover the internal tibial region. Does not this peculiarity, which appeared inexplicable to M. Boyer, depend upon the bone being slightly convex forwards and inwards, and upon its greater thickness externally? Does it not seem, in fact, that when a person falls upon the feet, the force must tend to augment this curvature, and that the internal laminæ being weaker and less numerous, must give way first?

Although, in these fractures, there is no muscle, as in the forearm, which has a special tendency to obliterate the interosseous space, it is nevertheless useful to press the fleshy mass into the interosseous fossæ, in any manner whatsoever, and especially by means of the anterior tibial compress.

The skeleton of the leg also merits much attention in amputations: in the first place relatively to the section of the muscles, which cannot be made by the circular method without carrying the point of the knife transversely upon the bottom of the interosseous fossæ, and which is also very difficult in the flap operation, especially as it regards the anterior flap, on account of the depth of the space in which the muscles are lodged; in the next, relatively to the interosseous space, which is broader the nearer it approximates the middle of the limb; so that at the upper and lower parts we may dispense with carrying the instrument through it, previous to sawing the bones; finally, it should be noticed, with respect to this last step of the operation, that, the leg being extended, the fibula is found greatly inclined backwards, and that if we do not take the precaution to turn the foot inwards, we will be obliged to elevate the wrist considerably, if we wish the saw to bear upon this bone and the tibia at the same time; the latter affording a greater purchase, being the thickest and most solid, should receive the first impression of the instrument, but should not be completely cut through in the first place, because the other is too slender and too moveable to support singly the action of the saw without breaking partially. It is in order to fulfil this indication that an established rule is always to stand on the inner side, during the amputation of the leg; al-

though this position of the operator is actually most convenient for the section of the bones, as it is not the same in all cases for the division of the soft parts, we should not consider it as indispensable ; for, it would not be much more difficult to make the division of the fibula previous to that of the tibia by depressing the handle of the saw, if we stood on the outside, than by elevating it, if we were placed on the inner side. Finally, after this division of the fibula, it is necessary to press the two divided ends against the tibia, in order to avoid jarring the two peroneo-tibial articulations. We will now readily perceive that, after the removal of the leg, the tibia presents a triangular section, the apex of which is directed forwards ; and as the skin which covers this angle is only lined by the subcutaneous tissue, we conceive that it might become attenuated, ulcerated or gangrenous, and at length leave the bone uncovered, if the reunion is not immediately effected ; for this reason, Bécclard, long since, and some English military surgeons, as stated by S. Cooper, have advised removing this osseous point with a stroke of the saw, and we are much surprised that a similar modification has not been generally adopted.

Relatively to the approximation of the soft parts upon these bones, it is evident, since their most remote borders are about two inches and a half or three inches distant, in the transverse direction, whilst from before backwards, their thickness is at most an inch and a half ; it is evident, we say, according to M. Richerand, that one of the angles of the wound must look inwards and forwards, whilst the other will be directed backwards and outwards. As to the amputation itself, by the circular method, there is but little variety in the processes. In fact, the superficial muscles only of the posterior region, being susceptible of retracting the skin towards the ham after their division, it is indispensably necessary to dissect this membrane, in the rest of the circumference of the limb, in order that it may cover the stump. It is then by the flap operation alone that it is possible to preserve the muscles before the ends of the bones. But this method, adopted by Graefe, at Berlin, and many other dexterous surgeons both in Germany and England, has scarcely been practised at all, in France, whether on account of its being found too difficult, or, on the contrary, because the circular amputation.

with all its inconveniences, still appears preferable. However, the thickness of the tibia and the want of sufficient soft parts to cover it, actually constitute the only obstacle to its adoption and we do not think that it is insurmountable; that perhaps it should not even be compared with the difficulty of dividing the muscles in the interosseous fossæ, and with the risk of not being able to preserve a sufficiency of them to envelope the ends of the bones, after the circular amputation. If we take the precaution to make a longitudinal incision two inches in extent upon the middle of the internal surface of the tibia, in order to relax it, we may then easily draw the posterior lip of this wound to a level with the internal border of the bone, so as to slide the knife upon its posterior surface in order to pass it through to the external side of the calf behind the fibula, and form the posterior flap. Then, it will be easy to draw the anterior lip of the first wound before the spine of the tibia, so as to be able to form an anterior flap similar to the preceding. Finally, after having sawed through the bones and raised more or less these two flaps, we might remove the angle of the tibia as in the circular method, and we do not then see what could oppose the immediate reunion. Besides, MM. Roux and Dupuytren have operated several times by this method, and, although several of the precautions just enumerated were neglected, the result has proved that it was not less advantageous than the common operation. On the other hand, we see that this amputation with flaps is quite different from that proposed by Lowdham at the close of the 17th century, and which was again brought forward by Verduin, and Sabourin, afterwards modified by Garengéot, Lafaye, etc. and in which only a single very thick flap was formed, at the expense of the calf, which was afterwards kept up and retained, by means of a machine, against the extremity of the bones, with the intention of obviating hæmorrhage, without being obliged to tie the arteries.

In both methods, there are always three principal vessels to tie when we amputate at the place of election: the anterior tibial, which we must isolate from its collateral nerve, and which rests directly upon the interosseous ligament, the posterior tibial, which is applied upon the anterior surface of the deep sheet of the aponeurosis, opposite to the point of contact of the flexor

longus digitorum pedis and tibialis posticus muscles: the fibular, which is enveloped in the fleshy fibres of the flexor longus pollicis pedis, and which exacts no precaution in the application of the thread. It is observed that these three arteries retract very much after the amputation of the leg, so much so that it is frequently necessary, in order to seize the first, to incise the interosseous ligament and detach it from the bones to a greater or less extent. We have already stated that M. Ribes attributed this great degree of retraction to the angle which this vessel makes, in passing from the posterior to the anterior region of the leg. Without rejecting this explanation altogether, which would only be applicable to the anterior tibial artery, we think that it is more natural to admit, with M. Gensoul,* of Lyons, that the anterior and deep posterior muscles, being attached upon the whole extent of the interosseous fossæ, cannot retract, whilst the vessels, enveloped in a supple and lamellated cellular tissue, retire considerably. When we operate a little higher, we must add to these branches the two surales and the nutritia tibiæ, previous to its entrance into its osseous canal. It should also be noted that, in certain cases, this small artery, although already included within the medullary canal, may pour out so much blood as to require the assistance of art; now, as it is not possible to seize it with the forceps or tenaculum, in order to tie it, we are obliged to cauterize it with a red hot iron, or compress it with a little cone of wax, lint or tow, which we press into the bony channel. But the first means seems to us to be the best, as it interferes less with the immediate re-union.

As the bones of the leg are almost as large at the inferior as the superior part of the limb, and as the muscles are reduced to their tendinous portion, inferiorly, it follows that in amputating above the malleoli, the skin is almost the only part which remains to cover the stump; therefore, it is admitted, notwithstanding the rule which requires that we should remove only the least possible portion of a limb, that the most suitable place for performing this operation is three or four fingers' breadth below the tibial tuberosity, whenever the disease does not oblige us to remove the limb at a more elevated point. It is in fact well ascer-

* Thèse inaug., Paris, 1823.

tained at present, that the cicatrix and the anatomical disposition of the parts, after the amputation of the leg in its inferior third, as recommended by White of Manchester, Wright, Bromfield,† Ravaton, and as Professor Vacca of Pisa, has also quite recently proposed, does not permit the patients, so operated on, to walk, without great difficulty, with the different machines employed by these surgeons.

ART. V. OF THE MALLEOLI.

This portion of the inferior extremity will also comprise the instep (*coudepiéd*), and the inferior part of the tendo Achillis. It presents internally and externally the two malleolar eminences, behind which we observe the termination of the *tibio* and *peroneo-calcien* gutters; transversely upon the instep, properly so called, we discover by the touch from within outwards, 1st, a depression, which separates the internal malleolus from the tendon of the tibialis anticus muscle; 2d, the prominence produced by this tendon; 3d, a second depression, which separates it from the tendon of the extensor proprius pollicis pedis; and 4th, another prominence corresponding to the extensor longus digitorum. We will now examine this part successively, inwards, outwards, forwards and backwards, in as many distinct sections.

Sect. 1. Internal Malleolar Region.

Upon the surface of this region we observe the eminence which gives to it its name, and a small excavation below and before the point of this eminence which separates the tendon of the tibialis posticus muscle from that of the tibialis anticus. In proceeding from the posterior border of the malleolus to the internal part of the heel, we feel at about six or eight lines from the first of these two eminences, a small relief which is only worthy of notice but inasmuch as it corresponds to the posterior insertion of the fibrous sheath which separates the flexor tendons of the toes from the other soft parts.

* Chirurg. Cases and obs. etc.

CONSTITUENT PARTS.

I. *The Skin.*

This membrane is delicate, thin, smooth, of slight extensibility, and contains but very few sebaceous follicles. Therefore, in the operations which we perform upon the internal malleolus, we should preserve as much of the integuments as possible, if we wish to unite the wound by the adhesive process. It equally follows from these characters that ulcers situated over it, promptly denude the bone, and finally occasion its necrosis. This is what we frequently observe, for example, subsequent to fractures of the fibula, when they have not been kept properly maintained, and when the external border of the foot has been turned more or less outwards.

II. *The Subcutaneous Layer.*

It is very thin and of a compact texture upon this malleolus, and does not enclose any or but very few adipose vesicles; so that after blows or contusions, extravasations or abscesses very rarely form in it. By tracing it to the periphery of this eminence, we will see it assuming the characters which distinguish it in the surrounding regions. Anteriorly, it is both lamellated and filamentous; the internal saphena vein as well as the saphenus nerve are imbedded in it; posteriorly, it is filamentous only, and forms a very dense and granulated cellulo-adipose layer; which accounts for the violence of the pain which patients experience when it is the seat of acute inflammation.

III. *The Aponeurosis.*

This is wanting, and the periosteum itself is very compact and firmly adherent to the bone; but the malleolus internus receives upon its anterior margin the extremity of the anterior annular ligament of the tarsus; and the internal annular ligament arises from its posterior border, in order to pass upon the internal and posterior eminence of the os calcis. It is from its apex that the

internal lateral ligament of the tibio-tarsal articulation originates. These three fibrous bands, which are sometimes blended at their margins, are in fact nothing more than an appendage to the aponeurosis, with which the two former are evidently continuous. Be this as it may, the internal annular ligament is the only one which it is necessary to examine here; being a continuation of the aponeurosis of the leg, the fibres of which are then stronger and more condensed, it converts the tibio-calcien notch into a complete arch, and thus binds down all the tendons, vessels and nerves which pass from the posterior tibial region to the sole of the foot. This arch is at first divided by a septum, which is nothing more than a continuation of the deep fibrous sheet of the leg, and which transforms the posterior interosseous fossa into a canal. Finally, the anterior portion of this sheath is in its turn separated into two rings by a second very short and very thick partition, the posterior of which is the broadest and least firm, and encloses the tendon of the flexor longus pollicis pedis, the posterior tibial vessels and nerves; the anterior, forms a very solid osso-fibrous canal, which is also subdivided into two thecæ, that which is posterior being for the passage of the tendon of the flexor longus digitorum, and the anterior, which is glued as it were to the posterior fossa of the malleolus, for that of the tibialis posticus. It is important to have this anatomical disposition in mind, when we wish to tie the posterior tibial artery behind the malleolar eminence.

IV. *The Muscles.*

They are here reduced to their tendinous parts, and are all situated behind the malleolus. The tendon of the tibialis posticus, the largest and shortest of all, being immediately applied against the posterior border of this eminence, it would be easy to open its sheath, by cutting about a line from this border; and as this sheath, as well as the tendon, are covered by a synovial membrane, a wound of this kind would scarcely fail to produce a very serious inflammation, and so much the more so, as it might be transmitted to the synovial capsule of the joint. It is well to remark, however, that as the tibialis posticus only goes as far as the os scaphoides, without mingling with the soft parts of the

foot, it does not necessarily follow that the inflammation of its sheath will produce suppuration of the deep parts of the plantar region.

A little further behind, we see the tendon of the flexor longus digitorum, which does not rest simply upon the posterior part of the malleolus, but upon the *tibio-astragalien* articulation, as well as upon that of the astragalus with the os calcis; whence it follows that an inflammation of its theca is much more dangerous than that of the preceding tendon. It is therefore of the greatest importance to avoid the sheath of these two tendons, when we wish to tie the posterior tibial artery, as well as in all the operations which we perform behind the malleolus internus.

The flexor longus pollicis pedis, yet possessing some muscular fibres, is found still farther back, exterior to the preceding thecæ, and in the same sheath with the vessels and nerves. It is at first enveloped in a pretty supple and lamellated cellular tissue, but soon enters a particular sheath, crossing obliquely, from behind forwards, and from without inwards, the posterior surface of the astragalus and the tendons above-mentioned, in order to reach the inferior face of the small head of the os calcis; so that, without having a distinct synovial membrane, the tendon of the great toe finally derives one from that of the flexor longus digitorum; from which circumstance an inflammation of one of these laminæ is, so to say, common to the other.

Sometimes, during the movement of flexion of the toes we hear a noise, a kind of snap, accompanied with pain and sometimes by swelling; this is a state similar to that which we mentioned when speaking of the tendons of the adductor longus and extensor brevis of the thumb; only we do not meet with it so frequently in the foot as in the hand; and, as the parts are more deeply situated it is more difficult to investigate it. A short time since there was a patient in the hospital of the Faculty in whom this affection was evident; but we have not ascertained that any person has had an opportunity of examining the state of the parts upon the dead body.

v. *The Arteries.*

Anteriorly we find several branches of the malleolaris interna :

but, the posterior tibial is the only one which merits any attention. We have already said that it was situated in the same sheath with the tendon of the flexor muscle of the great toe, and the principal nerve of the posterior tibial region. Its precise relations are the following: The tendon is external, the nerve behind and slightly external also; the sheath of the flexor longus digitorum is anterior and a little internal; the internal and slightly posterior side of the artery, is covered only by the portion of the internal annular ligament, which is continuous with the aponeurosis of the leg, or by this ligament itself. Consequently, we are sure of finding it, by making a semilunar incision two or three lines behind the malleolus internus: then, it is sufficient to divide the skin, the subcutaneous layer, which is of greater or less thickness and always very dense; finally, the aponeurosis, the fibres of which are transverse and more or less separated, proceeding cautiously, at all times, for the vessel, surrounded by its *venæ comites* and by a pretty compact cellulo-adipose tissue, is almost uniformly in immediate contact with the fibrous sheet just mentioned. It is of special importance, in performing this operation not to incise too near the malleolus, in order to avoid the tendinous thecæ, and not to remove too far from it, because we would then fall behind the artery; however, the latter inconvenience would be less serious than the former, and if the nerve is exposed, it will be easy to return to the artery, which is always before it. Nevertheless, it cannot be denied that this operation is not somewhat dangerous; and as that which is performed in the inferior third of the leg may always be substituted for it, we think that it should have the preference.

VI. *The Veins.*

The internal saphena, passing from the dorsum of the foot into the internal tibial region, generally runs over the forepart of the malleolar eminence; as it is subcutaneous, we sometimes puncture it in this place, but in fat subjects only, and when it is not sufficiently distinct above, because, when we can do it, it is much better to perform this operation higher up, on account of the proximity of the articulation.

The posterior tibial veins frequently form, in old men, or subjects affected with varices, a plexus so complicated as to embarrass the surgeon considerably when attempting to secure the artery, on account of the profuse discharge of blood which takes place, when we divide some of the branches which compose it.

VII. *The Lymphatics.*

One set principally accompanies the saphena vein ; the other, the deep-seated or posterior tibial vessels. They present nothing interesting in a surgical point of view, besides what has been noted in the preceding regions.

VIII. *The Nerves.*

The relations of the internal saphenus nerve with the saphena interna vein are the same as in the internal region of the leg. The posterior tibial nerve, which was, previously, on the outer side of the artery, soon places itself upon the posterior surface of this vessel, and is at length found even on its inner side, at the moment when it divides into two branches, on entering the plantar region, previous to abandoning the tibio-calcien arcade ; so that it is nearly equi-distant from the tibia in this region, whether we examine it above, below, or opposite the malleolus ; and, as the artery, on the contrary, deviates considerably from it, in descending, we conceive that what has been said respecting its ligature, applies only to the point which corresponds to the posterior border of this eminence.

IX. *The Skeleton.*

It naturally comprises the tibial malleolus, since it is this which forms the basis of the region ; it would also include the internal surface of the astragalus and a portion of that of the os calcis ; but as, in this direction, these parts enter more especially into the composition of the foot, we will merely indicate them here. With respect to the malleolar eminence, it is proper to note that it is prolonged sufficiently to conceal the tibio-astralagien articulation upon its internal side, which is thereby completely protect-

ed against the action of foreign bodies. As it is, moreover, oblique inwards, applied in a pretty close manner against the astragalus, pretty thin relatively to the volume of the tibia, and very firmly fixed by its apex to the small tuberosity of the os calcis, as well as to the rough portion of the tibial aspect of the astragalus, it may be broken in a violent twisting of the foot upon its internal border, rather than admit of luxation. Finally, let us note that the gutter which exists upon its posterior border, and which is continued below its apex by the internal lateral ligament, forms a complete pulley for the tendon of the tibialis posticus, and thereby renders this muscle very well adapted to raise the leg, and to lift the heel from the ground. The bottom of this groove, moreover, is lined by a very dense fibrous membrane, the free surface of which is frequently covered by a perfect cartilage, and which defends the synovial capsule of the joint during the action of the muscles.

Sect. 2. External Malleolar Region.

Its name sufficiently indicates its form and limits. Anteriorly, it is separated from the dorsum of the foot by an excavation, which is generally very deep, and which corresponds to the astragalo-calcien excavation; inferiorly and posteriorly, it is separated from the heel by the termination of the peroneo-calcien gutter, and by which we might easily penetrate into the articulation; finally, between these two depressions, and below the malleolus, we perceive a relief formed at first, by the peroneus longus and peroneus tertius tendons, afterwards by the tuberosity which exists upon the external surface of the os calcis.

CONSTITUENT PARTS.

1. The Skin.

It is thin, smooth and contains but few sebaceous follicles, it is also more supple and much more extensible than upon the malleolus internus; so that it permits the immediate reunion of wounds, provided the loss of substance is not very great; as well as the

accumulation of extravasations, the formation of abscesses, etc., and that it does not tear with the same facility when stretched by the violent turning of the foot inwards.

II. *The Subcutaneous Layer.*

This membrane is supple and lamellated even upon the malleolus, and is only filamentous behind it; still, this disposition is much less evident than in the vicinity of the malleolus internus; adipose cells are very numerous in it; in short, it retains nearly the same characters which it presented in the anterior tibial region; consequently it may contribute to phlegmonous inflammation, and permit pus or other extravasated fluids to enter into it from the surrounding regions, or escape from it, and diffuse themselves, when primitively accumulated in this region.

III. *The Aponeurosis.*

From the anterior and posterior borders, as well as the apex of the malleolus, where this lamina is, as it were, blended with the ligaments, we see it diverge under the form of more or less distinct bandelets, and pass upon the fore part and external surface of the os calcis, so that it does not evidently appear to make a part of the aponeurosis of the leg excepting directly posteriorly and superiorly. It is in this direction also that it forms a sheath for the peroneus longus and brevis muscles, which sheath is single as far as below the malleolus, but then a septum, which is fixed to the external crista of the os calcis, soon divides it into two distinct thecæ; therefore we may compare it to those which enclose the tendons of the tibialis posticus and flexor longus digitorum. Previous to its bifurcation, this osso-fibrous canal is very strong and solid; afterwards, it becomes weaker rapidly, and is finally converted into cellular tissue, at least so much of it as relates to the peroneus brevis.

IV. *The Muscles.*

The root of the extensor brevis digitorum pedis, lodged in the bottom of the astragalo-calcien excavation, is the only fleshy or-

gan which exists in this region, which is traversed, as we have just seen, by the tendons of the lateral peronei muscles. These tendons, as they are descending, are at first situated upon the external surface of the fibula, in the anterior region of the leg, but afterwards turn gradually behind it; so that the inferior and external fourth of this bone is quite naked under the skin; the sheath which encloses them appears to be only a continuation of the aponeurotic canal which kept them isolated from the other fleshy bundles in the leg; a sheath, the transverse fibres of which at length become approximated and condensed, so as to assume the characters of the tendinous thecæ. This sheath is consequently formed, posteriorly, by the aponeurosis, and, anteriorly, by the posterior surface of the fibula; next, by the external surface of the posterior inferior peroneo-tibial ligament, then by those which unite the malleolus externus to the bones of the foot. The septum intermediate to these two tendons, at first very thin, afterwards becomes so thick that it is difficult to conceive that the peroneus longus, which is behind it, can rupture this partition and pass into the canal of the flexor brevis. However, there are some facts extant from which it would seem that not only this, species of displacement has occurred, but also, that the sheath itself has been lacerated likewise, so as to permit the two tendons to ascend upon the external surface of the malleolus. Such an accident would be very serious, for, in addition to the pain and inflammation which might result from it, the action of the two peronei muscles would be inverted, that is, instead of being an extensor of the foot, in the same manner as the tibialis posticus, the peroneus brevis would act only as a flexor, and the action of the longus would be almost reduced to the abduction of the foot. With respect to the synovial membrane which envelopes them, as it is at first common to both, although that which appertains to the tendon of the brevis is soon lost upon the dorsum pedis, a wound of it is not therefore the less dangerous, because that of the longus readily transmits the inflammation into the plantar region.

v. *The Arteries.*

The malleolaris externa, the posterior branch of the fibular artery behind, when it exists, the anterior branch of the same trunk before, and some other twigs from the anterior tibial, are met with in this region; but they are arteries of small calibre, which do not merit any attention in the performance of operations.

vi. *The Veins.*

Some accompany the arteries which have just been mentioned, and are not more important; one only is worthy of notice, it is the saphena externa, coming, like the saphena interna, from the dorsum of the foot; it creeps also in the subcutaneous layer, and passes behind the malleolus in order to enter the peronco-calcien gutter. Although it is so large in some subjects that we might draw blood from it, nevertheless, we seldom open it, because this operation is generally more easy upon the saphena interna, which is also larger, and rests immediately upon the bones, whilst the former is applied upon the aponeurosis, and sometimes even upon the posterior surface of the tendinous sheath. It is moreover, equally approximated to a nerve, which is almost always situated anteriorly.

vii. *The Lymphatics.*

They follow in part the preceding vein, and some of them ascend into the anterior region of the leg; they are few in number and for the most part superficial.

viii. *The Nerves.*

The saphenus externus is the only one observed in the neighbourhood of the external malleolus; and as it gives numerous filaments to the external surface of the heel, it may and must concur in rendering phlegmonous inflammations of this part very painful. As it always lies very near the vein of the same name.

we are liable to wound it in bleeding from this vessel ; but as the saphena interna is equally accompanied by its collateral nerve, this accident is not peculiar to the external.

IX. *The Skeleton.*

It is constituted principally by the inferior fifth of the fibula ; and we may add to this a part of the external surface of the astragalus and os calcis ; it consequently comprises the inferior peroneo-tibial articulation, the fibrous apparatus of which is composed of the anterior and posterior peroneo-tibial ligaments, and of the yellow tissue which fixes the fibula in the sigmoid cavity of the tibia, and which we know by the name of interarticular ligament. Although immoveable, and very close, this articulation is nevertheless susceptible of *diastasis* or separation, and this accident appears frequently to accompany severe sprains. As it descends lower than the internal, the malleolus externus is better calculated to support the foot, which, from its position, has a constant tendency to turn outwards. The ligaments which bind it to the os calcis and astragalus are so strong that, if the foot is violently turned inwards, it will, by acting upon the fibula as upon a lever of the first order, rather produce its fracture than their rupture ; on the other hand, finally, like the internal, this malleolus conceals the tibio-tarsal articulation, and presents a still deeper groove upon its posterior surface ; it thus protects the synovial membrane of this joint ; but that of the calcio-astragalien articulation is so lax, that it frequently escapes between the two lateral peronei muscles, even before or behind their sheaths, thereby forming real *nodi* or ganglions, which we should be careful not to open.

Sect. 3. *Anterior Inter-Malleolar Region, or Region of the Instep.* (*Coudepied.*)

This part is comprised between the two malleoli, the head of the astragalus, and the anterior region of the leg, and presents exteriorly from within outwards ; 1st, the eminence formed by the tibialis anticus tendon ; 2d, the triangular depression which separates this tendon from that of the extensor longus pollicis ;

3d, another triangular depression, broader, but more superficial, the base of which includes the head of the astragalus ; 4th. lastly, the relievo formed by the tendinous bundle of the extensor digitorum longus and peroneus tertius. Internally and externally, these objects are separated from the malleoli by the two excavations which limit these two eminences on each side.

CONSTITUENT PARTS.

I. *The Skin.*

In the inhabitants of the country, those especially who are not in the habit of wearing stockings, the skin of the instep is very thick and rough ; in the adult man, in general, it is a little thicker than in the surrounding regions, and frequently presents transverse rugæ, which are evidently owing to the movements of the foot upon the leg ; wrinkles, however, which are never so deep that the incisions, which the diseases of this part require, should be made transversely ; it is sometimes shaded with hair, and contains numerous follicles, which pour out an abundant secretion.

II. *The Subcutaneous Layer.*

This is a continuation of the similar layer of the leg, and consequently contains a great quantity of adipose cells ; its laminæ, however, become closer and more compact as they descend, so that, from one malleolus to the other, the integuments are pretty firmly united to the anterior annular ligament of the tarsus ; and that subcutaneous infiltrations are generally stopped by this band ; therefore, superficial abscesses extend with difficulty from the lower part of the leg upon the dorsum of the foot ; and in children as well as in fat subjects, the instep appears as if strangulated. In a word, we here find a repetition of what exists upon the dorsal aspect of the wrist.

III. *The Aponcurosis.*

Continuous with that of the anterior tibial region, it is at first very thin and almost simply cellular ; after having formed the an-

terior annular ligament, it again becomes attenuated, in order to give rise to the dorsal aponeurosis of the foot. This transverse band, which unites the two malleoli, is remarkable, on account of the sheaths which it furnishes to the tendons. In fact, it is evident that, without it, all the flexor muscles of the foot, when contracting, would be considerably removed from the fore part of of the tibio-tarsal articulation, and that, together with losing a great part of their force, they would deform the limb. It is nevertheless so supple, that it is raised considerably by these tendons, making a relief of several lines during the contraction of their muscles. Upon the anterior border of the malleolus internus, it is strong and broad; almost immediately after, it appears formed of two bandelets placed one above the other, both of which split in order to form a sheath for the tendon of the tibialis anticus muscle, but in such a manner that the anterior plate of the superior layer is much stronger than the posterior, and that in terminating upon the fore part of the inferior extremity of the tibia, it binds down the tendon, which it envelopes, very firmly in this place, isolating it completely from the others. The posterior plate of the inferior part, on the contrary, is much stronger than the anterior, and it is this last particularly which constitutes the anterior annular ligament of the tarsus. After having ensheathed the tendon of the tibialis anticus, it splits anew in order to embrace, in the first place, that of the extensor proprius pollicis longus, and afterwards those of the extensor communis and peroneus tertius; so that the former is separated from the latter by a thin but strong partition, which bears a greater resemblance to synovial tendinous webs than to laminæ of a decidedly fibrous character.

IV. *The Muscles or Tendons.*

We find seven tendons traversing this region: that of the tibialis anticus, enclosed in its double sheath, and descending obliquely inwards and forwards, towards the os cuneiforme internum; that of the great toe, which slides in a softer sheath, and separated from the common ring of the extensors by a simple fibro-synovial lamina, runs obliquely from behind forwards and from without inwards, towards the dorsal surface of the first meta-

tarsal bone ; the four cords of the extensor communis, are collected in a bundle until after they escape from the annular ligament, when they separate in order to pass towards the roots of the last four toes : finally that of the peroneus tertius, which should only be considered as a fifth branch of the extensor communis and which passes in the same sheath. These different tendons, like all those which pass through fibrous sheaths, are covered by a synovial membrane which accompanies them in the form of a web as far as the dorsum of the foot, and communicates on the other hand with the synovial membrane of the tibio-tarsal articulation ; so that wounds which penetrate into these sheaths are extremely dangerous ; that sub-aponeurotic inflammations extend rapidly and soon become very serious ; finally, that, in operations the surgeon should use every caution in order to avoid opening them.

v. *The Arteries.*

The anterior tibial, which takes the name of arteria *pediæa* in this region, is the only considerable branch which we meet with in it, the malleolares are usually detached a little higher and the tarsea (*the dorsal of the tarsus*) is more anterior. The arteria *pediæa* then is situated between the extensor communis digitorum pedis and the extensor proprius pollicis, and is always a little nearer the malleolus internus than the externus. In order to discover it, it would be necessary to make an incision in the median fossette of the tarsus, parallel to the external border of the extensor tendon of the great toe, when we would have to divide the skin, the subcutaneous layer, the annular ligament, then a cellulo-adipose, lamellated layer, which is very firm and difficult to tear with the director ; but this ligature should never be attempted, on the one hand, because the artery is too deeply situated ; on the other, because it is not always easy to avoid the tendinous sheaths, the wounding of which might occasion severe inflammation ; in the third place, because the operation is very easy above the malleoli, is less dangerous, and equally advantageous.

VI. *The Veins.*

The principal are those which accompany and surround the arteria pedicæ. In fact the subcutaneous layer encloses only a quantity of ramusculi which run into the saphenæ, and rarely become varicose.

VII. *The Lymphatics.*

They are arranged in two orders ; the superficial vessels are irregularly disseminated, and ascend to the internal and anterior regions of the leg ; those which are deeper accompany the blood-vessels, and are, according to some anatomists, interrupted in their course, in certain subjects, by a small gland ; otherwise, they present nothing requiring particular attention.

VIII. *The Nerves.*

The two superficial nerves of the dorsum of the foot, branches of bifurcation of the musculo-cutaneous (*External Fibular Nerve*), are found in the deep laminæ of the subcutaneous layer, and diverge as they proceed towards the metatarsus ; so that they might be divided even by superficial incisions made upon the instep. The deep-seated nerves, the continuation of the anterior tibial, follow nearly the same direction ; the internal branch commonly remains on the corresponding side of the arteria pedicæ ; but the external usually deviates considerably from it ; both, as their name indicates, lie very near the bones, and are covered by the tendons.

IX. *The Skeleton.*

Formed by the fore part of the tibio-tarsal articulation, it presents for examination only the anterior portion of the mortise of the bones of the leg, and a part of the superior aspect of the astragalus. As the synovial membrane is supported in this direction merely by a lax, weak and very supple fibrous lamina, we conceive that, if a great quantity of fluid was accumulat-

ed within it, it would easily project below the annular ligament, and especially in the lateral or malleolar excavations of the instep. The articular surface of the astragalus being convex from before backwards, and forming a species of pulley, it permits considerable flexion of the foot upon the leg; which flexion is likewise favoured by the notch which we find before this articular surface and which separates it from the head of the bone. On the other hand, however, as this same notch strikes against the anterior border of that of the tibia, it almost insuperably opposes luxations of the leg forwards, unless the point of the foot, by a mis-step, is turned very much downwards, or the weight of the body is increased by a fall or by a more or less heavy burden. When this displacement has taken place, the tibia is found carried back upon the posterior notch of the os calcis, and is only stopped there by the tendo Achillis. Then the dorsum of the foot must be very much bent upon the fore part of the leg; and, if there is no complication, it does not seem that the reduction will be very difficult. It is sufficient to pay attention to the manner in which the astragalus is encased within the peroneo-tibial mortise, in order to be convinced that it is very different when the luxation is inwards or outwards. Every one knows, in fact, that the latter, species of displacement, can rarely be accomplished without involving the laceration of the lateral ligaments, the separation of the tibia and fibula, the fracture of the malleoli, or the simultaneous luxation of the astragalus upon the os calcis.

Before we abandon this point, let us remark that the articulation is so badly protected in the region under consideration, that a foreign body, a puncturing or cutting instrument may easily open it, especially if they penetrate it by the different fossettes indicated when speaking of the surface of the instep.

Sect. 4. Posterior Inter-malleolar Region, or Region of the Tendo Achillis.

This region only presents, properly speaking, as worthy of some attention, the termination of the tendo Achillis, because the heel, which it would seem to comprise below, necessarily appertains to the foot. We may say, however, that it includes all the parts which rest upon the posterior notch of the os calcis, as well

as upon the posterior surface of the tibio-tarsal articulation, always with the exception of those which have been examined in the preceding region. Upon its surface we observe the broadest portions of the peroneo and tibio-calcien gutters, which separate it from the malleoli. The tendo Achillis forms a perfectly insulated cord, which is very remote from the articulation of the leg; so that it is by this part, says the fable, that the mother of Achilles held this hero, while yet an infant, when she plunged him into the waters of the Styx. Be this as it may, the greater the degree of this separation, the longer is the arm of power of the lever which the foot represents, and consequently the greater the firmness in standing and the facility of progression. It also follows from this disposition, that a sword, or any similar weapon, might easily traverse the leg, from one side to the other, before the tendo Achillis, without wounding this cord, or touching the vessels, tendons or deep-seated muscles.

CONSTITUENT PARTS.

I. *The Skin.*

This membrane, very thick, rough, cracking with great facility, especially behind, gradually becomes thinner upon the sides, and soon assumes the characters of that which covers the malleoli. It is very seldom covered with hairs; but includes many sebaceous follicles.

II. *The Subcutaneous Layer.*

It is very dense, filamentous, of a fibrous nature, contains many vesicles, arranged in clusters, and adheres very closely to the aponeurotic and cutaneous laminæ. As it approximates the heel it becomes elastic, its thickness increases, in a word, it begins to partake of the nature of the fibro-adipose cushion, which we shall soon see in the plantar region of the foot. Above the heel it is already so compact, that punctures, contusions or other wounds speedily produce inflammation in it, accompanied with extremely acute pain. We find in it, besides, numerous nervous filaments, derived from the posterior tibial nerve, from the internal saphe-

nus on the inner side and the external saphenus on the outer. Sometimes, also, venous ramuscles, which go to empty into the saphenæ, form a species of plexus in it on either side, and give to the integuments that bluish aspect which they then present.

III. *The Aponeurosis.*

It is here that we find the termination of the three sheets of the posterior region of the leg ; so that, on the one hand, these laminæ become continuous, as we have seen, with the calcio-malleolar fibrous bandelets, and the sheaths of the tendons, and that on the other, they entirely and gradually disappear, posteriorly, in the subcutaneous elastic cushion. As they are separated from one another by a tissue similar to that which forms the cushion just mentioned, it follows that the natural barriers which might at first exist between the deep-seated and superficial phlegmonous inflammations are soon overcome, and that the abscesses of this region almost always penetrate to a great depth.

IV. *The Tendon of Achilles.*

It is remarkable here, as well as throughout its whole extent, for its strength and volume, and also for the manner of its insertion upon the os calcis. In fact, it is only fixed into the inferior half of the posterior surface of this bone : so that it is separated from the other half of this surface by a very distinct synovial bursa, which is sometimes filled with fluids. Thus disposed, the tendo Achillis may act with greater power upon the heel ; and a transverse wound of it, an inch above its termination, might also separate it completely from the os calcis : its relations with the tibio-tarsal articulation are very remote, and its rupture, in this region, presents the same peculiarities as in the inferior part of the region of the leg, excepting that, if this rupture took place quite low down, the adhesion of the parts being stronger, its retraction would be much less ; and it is thus that the case related by A. Paré seems to us to be pretty naturally explained.

v. *The Arteries*, vi. *The Veins*, vii. *The Lymphatics*,
viii. *The Nerves*.

They are of no surgical importance in this region.

ix. *The Skeleton*.

The os calcis, supporting the weight of the body upon the middle part of its superior surface, passes so much beyond the leg behind, that it might be broken by the action of external agents, or by that of the gastrocnemii muscles. On the other hand, the transverse rounded notch, which separates its articular surface from the tendo Achillis, concurs in the formation of that species of vault or deep gutter which we observe upon its internal surface. As the tibial malleolus does not descend so low as the external, it is consequently necessary for the internal lateral ligaments to support a much greater effort, when the body is erect. than the external, and this is partly the reason why luxations are more frequent in this direction. With respect to the posterior aspect of the tibio-tarsal articulation, we see that the ligaments slightly increase the depth of the peroneo-tibial cavity, and that the astragalus, sloping considerably, but not passing beyond them behind, is much more easily driven forwards, than in the latter direction. However, we conceive, from the weakness of these ligaments, and the disposition of the surfaces, that, in certain cases of forced extension, the leg might be driven upon the dorsum of the foot, and the astragalus thrown back upon the posterior surface of the tibia. Let us also note that the synovial articulatory capsule is no better supported behind than before, and that, if it was not for the deep-seated tendons of the leg, it would very easily form tumours at the posterior part of this articulation.

The order of superposition is too simple, and presents too few surgical applications in the different regions which have just been passed in review, to require us to give a description of it. Besides, it is nearly the same as in the corresponding regions of the leg.

ART. VI. OF THE FOOT.

This part, which resembles the hand in many respects, is disposed in such a manner that its inferior surface bears horizontally upon the ground, in the vertical position, and that its superior surface receives the weight of the body, towards the union of the three anterior fourths with its posterior fourth. It is of a triangular form, the base of the triangle represented by the toes, and the apex by the heel.

Sect. 1. Dorsal or Superior Region.

Bounded by the instep (*coude-pied*) behind, and by the junction of the toes before, this region does not, as we perceive, comprise the whole extent of the superior surface of the foot, because the articulation of the leg occupies a pretty considerable part of it. Internally and posteriorly it is more or less convex, becoming gradually flattened and seeming to expand anteriorly and externally. Posteriorly, we observe a relief, which is quite distinct in certain persons, and which corresponds to the fleshy portion of the flexor brevis digitorum muscle. In passing towards the internal border, we observe the continuation of those different eminences and depressions which were noticed when speaking of the instep. Anteriorly, we feel through the skin, especially in emaciated persons and when the toes are extended, the tendons which appertain to them, and their intermediate grooves. If we examine them very minutely, by means of the touch, we will also discover a great many other objects, even more important than the preceding ; but as they relate particularly to the articulations and to partial amputations, we will attend to them when we come to speak of the skeleton.

CONSTITUENT PARTS.

1. *The Skin.*

In youth and in the female, it is delicate, smooth, pretty extensible and very supple. In man it naturally supports, upon the

most convex part of the region, a small group of hairs. It is also thicker in this point, and, as in the instep, it is not rare to see it rough, cracked and covered with scales in peasants; occasionally also it becomes so thick, in those who wear large wooden shoes, as to form a hard and more or less voluminous tumour upon this point. The same cause frequently occasions its ulceration, and, in all cases, wounds with loss of substance, occurring here, are always tedious in cicatrizing. Elsewhere, the skin possesses such a degree of mobility, that its recent divisions are easily united by the first intention.

II. *The Subcutaneous Layer.*

Its thickness varies considerably. In women and children it frequently obliterates all the inequalities of the region, whilst in man it is seldom that it acquires an equal degree of thickness. It is not that the adipose cells are more abundant in one case than in the other, but because it is composed of lamellæ susceptible of more or less condensation or rarefaction: therefore, although thin and, as it were, aponeurotic, in emaciated subjects, as soon as inflammation is developed in it, it promptly becomes the seat of a considerable tumefaction; suppuration even takes place in it with great rapidity, and as its adhesion with the skin and subjacent tissues is not very intimate, phlegmonous erysipelas of this part is soon followed by a very extensive burrowing; whence it follows that we should always open purulent or other collections in this region, as soon as we are positive of their formation. This anatomical disposition of the subcutaneous layer should also be recollected in partial amputations of the foot, because it permits us to draw the integuments considerably backwards, so as to render unnecessary the dissection of the skin which we afterwards intend to draw over the extremity of the stump, bearing in mind, always, that this mobility does not exceed certain limits.

III. *The Aponeurosis.*

The fascia of the dorsum of the foot has generally been described in a very superficial and frequently very inaccurate manner: it is composed of two sheets, which we may consider as

originating from the tibial border of the region. These two laminae then separate in order to embrace the extensor tendon of the great toe, thus forming a continuation of its sheath; on the outer side of this tendon they are again in contact, when they separate anew in order to pass, one over the superficial surface, the other under the deep surface of the flexor brevis muscle, of the tendons of the extensor communis and peroneus tertius, and finally re-unite on the outer side of the latter, in order to be inserted into the external border of the foot, by becoming blended with the periosteum and continuous with the plantar aponeurosis. Posteriorly, this double lamina is evidently a continuation of the aponeurosis of the instep, and anteriorly, its two layers, being no longer separated but by the tendons, approximate and unite with the synovial web which joins these fibrous cords; they also gradually become thinner, and are finally lost in the cellular layer of the dorsum of the toes. From this, we conceive that two species of abscesses may exist in the foot: one, having its seat in the subcutaneous layer, may exist for some time without affecting any other elements than those which are situated between the aponeurosis and the skin; the other, which is developed between the sheets of the fascia, almost always leads to mortification of the tendons, and persists a greater length of time than the preceding before it is recognised; but frequently the inflammation of one of these layers is transmitted immediately to the other, and the pus, at first accumulated under the aponeurosis, soon penetrates this barrier, in order to place itself in the subcutaneous layer and elevate the skin: the fluctuation, besides, in either case, is readily distinguished, because the soft parts are generally of but moderate thickness.

iv. *The Muscles and Tendons.*

These are the same as in the instep, and besides, almost the whole of the extensor brevis digitorum: thus, internally, we see the continuation of the tibialis anticus tendon, which passes on the fore part and inner surface of the os scaphoides, to its insertion into the inferior border of the os cuneiforme internum. When it is tense, this tendon is so much raised, that it might be completely cut across, yet the tibio-tarsal articulation escape uninjured. The

next is that of the long extensor of the great toe, which crosses, with a very slight degree of obliquity, the articulations of the astragalus and scaphoides, of the scaphoides and internal cuneiform, and of the latter with the first metatarsal bone, previous to reaching the toe into which it is inserted, and as it receives from the aponeurosis a distinct fibrous sheath, which is stronger before than behind, it may act freely, and independently of those which surround it; so with its synovial membrane which may also be affected separately, and may be divided by a cutting instrument, bearing upon its superior surface from the inner border of the foot, without the others being molested. More externally, we observe the four tendons of the extensor communis; in proportion as they separate, they extend the synovial tunic which embraces them at the instep, and thereby convert it into a membrane. In their course towards the back of the toes, they diverge, and cross, obliquely outwards and from behind forwards, the external surface of the extensor brevis digitorum muscle. With respect to the peroneus tertius, we know that it expands upon the superior surface of the fifth metatarsal bone. As all these tendons pass between the sheets of the aponeurosis, we see to what depth we may penetrate without reaching them; and also, from their direction and the space which exists between each of them, in what manner to make incisions in order to avoid them, and by what wounds they will be most frequently divided.

Lastly, we observe the extensor brevis digitorum pedis (*pédiæux*), which arises by a point from the astragalo-calcien excavation, and soon splits into four, sometimes even into five portions, which pass to the first four toes, in the one case, and to the whole five in the other. Of all its portions, the internal, or the first, is the most important in surgery and generally the largest. In its course towards the great toe, it approximates the first tendinous branch of the extensor longus communis, which crosses it, and which it soon passes beyond on the inner side, so that it is upon its internal border that we must seek for the arteria pediæa. In passing a little from without inwards, in order to reach the root of the toes, this small muscle is disposed in such a manner that we will not fail to divide it completely across, in operations which require deep incisions, if we wish to preserve the tendons of the extensor longus communis.

v. *The Arteries.*

The dorsal artery of the foot (*arteria pediaea*.) which is the continuation of the anterior tibial, is the only one deserving of attention; it is separated from the bones merely by a fibrous lamina which is confounded with the ligaments; it follows pretty exactly the direction of a line drawn from the middle of the instep upon the posterior extremity of the first interosseous space. In this track it rests upon the head of the astragalus, the articulation of this bone with the os scaphoides, upon the dorsal surface of the latter, and finally, upon the articular interstice of the first two cuneiform bones. Relatively to the tendon of the extensor of the great toe, we should recollect that at the instep, as well as in the leg, it was on the inner side of it; here, its relations change: opposite to the head of the astragalus, or a few lines more anteriorly, it lies on its external side; the internal branch of the deep nerve of the dorsum of the foot runs along its inner side, between it and the preceding tendon; externally, it is at first coasted by the first tendon of the extensor longus digitorum communis, which is about two or three lines distant from it when it reaches the back of the second metatarsal bone; on this side, it is the first fasciculus of the extensor brevis digitorum which contracts with the artery the most important relations. Posteriorly, it is at first several lines distant from it; but gradually approximates it as it advances forwards, so that the internal border of this bundle finally covers the artery; whence the necessity of reflecting the former outwards in order to seize the latter: lastly, the *arteria pediaea* is covered by the two laminae of the aponeurosis, the subcutaneous layer and the integuments; consequently if we wish to tie it, it will be necessary, in order to find it with certainty, to incise the parts in the direction of the line previously indicated, so as to fall upon the interval which separates the extensor proprius pollicis from the extensor communis. After having divided the skin, the cellular layer and the superficial sheet of the aponeurosis, we should separate these two tendons, avoiding as much as possible the kind of sheath in which each is enveloped; the extensor brevis muscle must also be slightly drawn outwards: then the artery will be seen through the deep

fibrous sheet, which should be divided upon a grooved director ; finally, in order to preserve the nerve, we must pass the ligature under the vessel from within outwards.

The dorsal arteries of the tarsus, and metatarsus, given off by the *pediæa*, are too small to furnish any indication in surgical operations ; but it is proper to note that two principal ramuscles which originate from the internal part of the same trunk, and run along the tibial border of the foot, passing between the tendons of the *tibialis anticus* and *extensor proprius pollicis* muscles. In fact, if the tissues upon the dorsum of the foot, anterior to the first of these tendons, are divided in certain subjects, in whom these branches are very large, a profuse hæmorrhage might be the consequence, although the *arteria pediæa* itself may not have been wounded.

VI. *The Veins.*

It is in this region that the two *saphenæ* derive their origin from a large arcade, the convexity of which, turned forwards, receives all the superficial branches of the dorsal surface of the toes ; included in the subcutaneous layer, and covered by the skin only, raised also by the *extensor* tendons, it sometimes happens that this arcade appears more voluminous than the two veins of which it is the root ; so that, in some subjects, we are obliged to prefer it for the abstraction of blood from the foot. Nevertheless, venesection in this place is not a matter of indifference, because the proximity of the tendons and the mobility of the tissues may render it more difficult, and lead to more dangerous consequences. Besides, as it only receives the small veins of the toes, we can seldom draw away a great quantity of blood by opening this venous arch. The flaccidity of the *laminæ* which enclose it, permits the more or less numerous twigs which open into its concavity, as well as all the venous branches of the dorsum of the foot, in general, to dilate promptly ; therefore, favoured by the tenuity of the vascular parietes, by the height of the column of blood, and by the most dependent position of the body, varicose clusters, or a more or less complicated plexus, are frequently produced upon the dorsal region of the foot ; but from the common relations of these varices with the tendons, we may readily fore-

see, that it would not be prudent to apply to them the treatment by incision or excision with or without the ligature, introduced with modifications and great advantage, of late years, by M. Richerand, Béclard, and M. Lisfranc.

Each arterial branch is equally coasted by two venules ; the two veins which accompany the anterior tibial artery, are also found on each side of the arteria pediæa, and are generally so remote from this branch, at the point where we apply a ligature upon it, that it will be easy to distinguish them by the colour of their blood, when they are full, or by the tenuity of their coats, if they are empty ; when, however, they are found immediately applied upon the artery, as their physiological importance is not great, it is much better to include them in the same thread, than to make vain attempts to separate them.

VII. *The Lymphatics.*

The superficial set is the only important one ; as it comprises the roots of a certain number of those lymphatic vessels which go to the groin, it is not surprising to see, in certain individuals, inflammations and other affections of the dorsal surface of the foot, produce tumefaction of the glands of the groin or in some other point of the pelvic extremity ; they seem to perform an important part, especially in phlegmonous erysipelas arising from a puncture or some wound in a state of suppuration. In fact, we frequently see, in these cases, the redness disseminated in patches, or under the form of more or less distinct striæ, and thus propagate itself from the inferior towards the superior parts, etc.

VIII. *The Nerves.*

This system here appertains to four principal branches ; the two sapheni, the musculo-cutaneous (*external fibular*), and anterior tibial nerves.

The internal saphenus is almost entirely lost before it reaches the base of the first metatarsal bone ; it always follows the vein of the same name, creeps in the lamellæ of the subcutaneous tissue, and seems to terminate in the skin.

The saphenus externus passes even to the toes, to which it gives

even distinct filaments ; it also accompanies the saphena externa vein ; but we find it nearer the aponeurosis than the preceding, indeed we might say that it is enclosed in a sort of sheath appertaining both to the aponeurosis and subcutaneous layer. Nevertheless, by ultimate analysis, it appears to be lost in the cellular tissue and the integuments.

The two superficial dorsal nerves of the foot creep in the deepest laminae of the subcutaneous layer ; so that they are more distant from the skin than the veins, yet, nevertheless, are always separated from the tendons by the aponeurosis ; like the two sapheni, they disappear in the cellular tissue and skin, and, from the distribution of these four cords, we may presume that they preside especially over the sensibility of the soft parts of the region ; which sensibility, if this opinion is correct, would be completely destroyed by the division, or rather excision of a small portion of the sapheni and musculo-cutaneous nerves above the malleoli ; but as this has not yet been proved by experiment, it must be regarded, at present, as a mere hypothesis.

The two deep branches of the dorsum of the foot, terminations of the anterior tibial, applied almost directly upon the bones, are so arranged that the internal almost always runs along the tibial side of the artery, whilst the external ramifies particularly in the deep fibres of the extensor brevis digitorum muscle ; so that, if the preceding nerves preside over the organs of sensibility, the latter must appertain to those of locomotion.

IX. *The Skeleton.*

This comprises all the bones of the tarsus and metatarsus, and is interesting especially on account of the articulations. It also determines the form of the region. Previous to passing in review the direction of the articular surfaces, it is proper to examine upon the surface the different objects by which we may recognise them, and this examination deserves the more attention as it will serve as a sure guide in partial amputations. Thus, by tracing with the index finger the external border of the foot from the heel towards the little toe, we meet with, 1st, the external and posterior prominence of the os calcis ; 2d, the termination of the peroneo-calcien gutter ; 3d, below, and an inch before the

malleolus externus, the tubercle or crest which we see on the external surface of the os calcis, and which separates the two lateral peronei muscles from each other; 4th, about fifteen lines nearer the toes, the posterior prolongation of the fifth metatarsal bone; the eminence formed by this bone being the largest, least variable and always distinguishable through the soft parts, even when they are infiltrated and swollen, is therefore that which presents the greatest interest; 5th, the notch, or space which separates this eminence from the peroneal crest of the calcaneum, being divided into two equal portions, we fall upon the union of the os cuboides with the os calcis, that is to say, that this joint is found about seven or eight lines from either of these tuberosities; 6th and lastly, by continuing to carry the finger forwards, we feel the external border of the last metatarsal bone, which, however, presents nothing very remarkable.

The internal border of the foot, comprising a greater number of articulations, also presents many more reliefs and depressions than the external: from behind forwards, we meet with, 1st, the internal and posterior prominence of the heel; 2d, a large notch, which separates this prominence from the malleolus internus, and continues the tibio-malleolar gutter; 3d, under the malleolus, but in some subjects only, the small tuberosity of the os calcis; 4th, some lines further forwards, a tubercle, which we render very prominent by turning the external border of the foot outwards, and which is formed by the head of the astragalus; this eminence is sometimes augmented by the tendon of the tibialis posticus muscle, which naturally passes below, and in certain subjects, old men especially, a sesamoid bone is developed in it, which renders it still much more prominent; so that it might easily be mistaken for the tubercle of the scaphoides, if we did not reflect upon the distance which ought to intervene between the latter and the malleolus internus; 5th, the internal and inferior prominence of the scaphoides, which is found about an inch before the malleolus, and separated from the preceding tubercle by a pretty deep notch, which conducts obliquely outwards and forwards into the astragalo-scaphoid articulation, so that the prominence under consideration is a certain guide in amputating the foot, according to the method of Chopart. In fact, since M. Richerand pointed out this peculiarity in 1801, the ope-

ration just mentioned has become one of the most easy in surgery; whilst previously, surgeons could not succeed in executing it without a great deal of fumbling, so much so that even in 1799, a dexterous operator, at the head of one of the great hospitals of Paris, was three quarters of an hour in performing it, notwithstanding he then had the foot of a skeleton before him; 6th, a little further, about six or eight lines, we meet with a depression of slight depth and frequently difficult to feel, which corresponds to the junction of the scaphoides and first cuneiform bone; 7th, an inch further forwards, we find the anterior and inferior expansion of the first cuneiform, then the internal eminence of the posterior extremity of the first metatarsal bone, and between these two reliefs a slight groove, but a little more strongly marked than the preceding, however, and which leads into the joint. It should be observed that we can distinguish these last objects more readily, by seeking for them from before backwards than by following the direction which we have just traced, and, on the inner border of the foot, by approximating the plantar rather than the dorsal surface. In fact, it is for want of attention to this rule, says M. Lisfranc, from whom we have borrowed the most of these data, after having verified them a great number of times upon the dead body, that students do not derive from these features all the advantages which they might expect, in performing the partial amputation of the foot, according to the method which he has proposed. Furthermore, a more convenient and therefore better method, since it is equally sure, and because the unnatural state of the parts does not prevent its application, consists in drawing a transverse line from the posterior projection of the fifth metatarsal bone, upon the inner margin of the foot; this line will then fall upon the first cuneiform bone, two or three lines anterior to its articulation with the scaphoides, and the first cuneo-metatarsal joint exists about two lines further forwards. 8th and lastly, by continuing onwards, we arrive at the expanded phalangeal extremity of the first metatarsal bone, and upon the inner border of the big toe.

The dorsal surface of the foot also presents certain characters which may assist in ascertaining the situation of some of the articulations, and, in particular, of those which we traverse in the amputation, according to the method of Chopart. If we adduct

and extend the foot, afterwards examining the external malleolar excavation of the instep, we see that it is bounded, posteriorly and externally, by the fibular malleolus ; inferiorly and externally, by the calcien crest, and that there exist, anteriorly, two other eminences ; one, external, about twelve or fifteen lines before the corresponding malleolus, is formed by the external and superior aspect of the great tuberosity or head of the os calcis ; the other, internal, long since pointed out by M. Dupuytren, is nothing more than the head of the astragalus. The latter is found separated from the tibia by an interval of about an inch, and by a kind of neck upon which it is important that we do not direct the knife, when we wish to disarticulate the foot at the junction of its two tarsal rows ; which junction exists immediately before these two eminences, and about two inches behind and internal to the posterior extremity of the fifth metatarsal bone.

It was necessary to point out these features previous to examining the direction of the articular surfaces which we may now pass in review. Let us first stop for a moment upon those which it is necessary to separate in the partial amputation of the foot, after the method of Chopart.

As the astragalus is encased in the posterior cavity of the scaphoides, it is necessary, in order to penetrate between them by the internal side, to commence by carrying the instrument in the direction of a line which would pass obliquely outwards towards the posterior extremity of the last metatarsal bone. This being done, it is easy to continue the opening of the joint by making a semilunar incision, with an anterior convexity, upon the head of the astragalus, carefully avoiding to let the knife glide upon the neck of this bone. When we have reached the outer side of this joint, we must penetrate between the surfaces of the os calcis and cuboides, which are directed outwards and slightly forwards ; so that if the incision prolonged the preceding semicircle outwards, it would fall upon the astragalo-calcien notch, instead of opening the calcaneo-cuboid articulation. We have frequently seen students commit this error, which may readily be done because this excavation seems to be the continuation of the astragalo-scaphoid union ; but it may be avoided, by recollecting what was said when examining the external border of the skeleton.

Thus we see that, supposing a plane surface, similar to that of the calcaneum, existed in the place of the head of the astragalus. these bones would form two oblique planes behind, and inclined towards one another, so as to circumscribe a triangular sinus, in the summit of which we would find the external and posterior extremity of the scaphoides, and the posterior and internal angle of the cuboides; consequently, it is before the base of this sinus that the division of the soft parts should be made. This incision, being slightly convex forwards, and one of its extremities placed immediately behind the scaphoidien tubercle, the other an inch behind the fifth metatarsal bone, will comprise the skin, the subcutaneous layer, including the saphenous veins and nerves, as well as the superficial nerves of the dorsum of the foot, the aponeurosis and the tendon of the tibialis anticus, of the extensor communis digitorum, peroneus tertius and even of the two lateral peronei muscles, as well as the arteria pediæa and the deep dorsal nerves. As all these parts slide easily over the skeleton, by cutting them exactly upon the line of the articulations, they will not fail to retract, and leave a portion of the superior surface of the bones uncovered, which would oblige us to give still greater length to the plantar flap; by dividing them on the contrary, as we have pointed out, that is to say, some lines anterior to the joints, an assistant can draw them pretty easily towards the leg, so that it will not be necessary to make other two incisions parallel to the borders of the foot, in order to reflect the flap, as advised by Chopart. Be this as it may, nothing now remains but to divide the ligaments, in order to open the joint extensively. If we begin at the inner border, which is always most certain, whenever the thing is practicable, we first meet with the tendon of the tibialis posticus, and a fibrous expansion which originates from the fore parts of the malleolus internus; then the anterior tibio-tarsal ligament, or rather the astragalo-scaphoid which is only a continuation of it. Then, if we have followed the semi-lunar line represented by the head of the astragalus, we arrive at the bottom of the sinus noted above, and the knife must divide the very strong ligament which occupies a part of the astragalo-calcien excavation, and which is also prolonged upon the scaphoides and cuboides. This being the strongest and most compact ligament, as soon as it is cut, the bones easily separate :

but, it is at this moment that we must change the direction of the instrument, and incline its edge obliquely outwards and forwards, in order to divide the dorsal calcaneo-cuboid ligament, and the tendon of the peroneus longus. It is unnecessary to say that, when we commence by this last point, we must follow a direction inverse to that which we have just mentioned. Let us remark that at the bottom of this wound, we still find all the plantar ligaments, which are numerous and very strong, and which should likewise be divided, before we cut the flap in the soft parts.

As the tarso-metatarsal surfaces are still closer, and especially much more numerous, their articulation is consequently much more complex. It is long since Garengéot * and Sharp † advised the removal of the metatarsal bones alone, when they were exclusively diseased, and that the operation was executed in the presence of these surgeons. Turner of North-Yarmouth, as related by Hutchinson ‡, performed it in 1787. Hey described it in 1810. § But it must be admitted that previous to the researches of M. Lisfranc, the notions entertained upon this point were very vague, and that, in this respect, the surgeon-in-chief of the Pitié has indeed rendered a very important service to French surgery: now, in fact, it is almost as easy to amputate in the tarso-metatarsal articulation as between the tarsal rows, and no one contests the advantages which the former of these operations possesses over the latter, whenever it can be substituted for it.

If we commence with the articular inter-line externally, we will observe that the two corresponding plane surfaces of the cuboides and fifth metatarsal bone are oblique inwards and forwards, and that in order to slide the knife between them, we must carry it in the direction of a line drawn from the posterior part of the last metatarsal bone to the phalangeal extremity of the first. After it has passed about six lines, it meets with the union of the cuboides with the fourth metatarsal, which is almost transversal; so that it is sometimes necessary to carry back the instrument about half a line, in order to penetrate this joint. The union of the external cuneiform with the third metatarsal is

* Opérations de chirurgie, tom. 3. † Opérations, etc. ‡ Pratical Observations page 70. § Obs. in Surgery page 535.

also nearly transverse, but sometimes a little anterior to the preceding. When we have separated them, we transfer the knife to the inner side of the first tarso-metatarsal articulation, which is situated three lines nearer the toes: here, the surfaces are oblique in two directions, from above downwards and from before backwards, on the one part; from within outwards and from behind forwards, on the other, and in the direction of a line which would pass externally upon the middle part of the fifth metatarsal bone. If we forget this double direction, we may fumble for a long time before we will be able to penetrate between these two bones. Lastly, we find the articulation of the second metatarsal bone, which passes three or four lines beyond the first and from a line to a line and a half beyond the third, posteriorly. It is found wedged in a mortise formed for it by the three cuneiform bones, which mortise is broader above than below and before than behind; its external paries, constituted by the cuneiforme magnum, is about three or four lines long, and very slightly oblique from behind forwards and inwards; the internal, a line or two in length, slightly oblique forwards and outwards, is sometimes wanting. Finally the posterior wall is plane and quite transversal.

Now, in order to separate the metatarsal portion of the foot from its tarsal portion, we must in the first place divide, with a single stroke, the skin, subcutaneous layer, the aponeurosis and extensor tendons of the toes, some vessels and nerves, in the direction of a line slightly convex anteriorly, departing from the posterior tubercle of the fifth metatarsal bone, and terminating upon the tibial border of the foot, at an inch nearer the toes. Next the point of the instrument separates the last two metatarsal bones from the cuboides, following, for the fifth, the line which falls behind the great toe, and a direction much less oblique for the fourth; for the third, we carry the knife a little further forwards, but almost directly transversely; then we pass to the first, which we disarticulate in the direction of the line indicated when speaking of its articulation. All that then remains is to separate the second from its mortise, and we will succeed in it by placing the point of the knife perpendicularly having its edge turned backwards, as soon as we have arrived at the external side of the first cuneo-metatarsal articulation. It is at this moment important, the back of the knife leaning against

the posterior extremity of the first metatarsal bone which supports it, to make its handle swing forwards, in order that its point may divide the very strong interosseous ligament which firmly unites the corresponding inferior lateral parts of the first cuneiform and second metatarsal bones, paying attention at the same time to the obliquity of these surfaces. Then, we have only to seek for the joint between the second metatarsal and the second cuneiform, which we will always easily find by going from the articulation, already opened, of the third cuneiform and third metatarsal bones, from a quarter of a line to two lines posteriorly: at least, we have never met with varieties which were not included between these two extremes. But all these articulations are covered by the dorsal ligaments, which must be divided before they can be opened; the first metatarsal bone, for example, receives a very thick one from the cuneiforme magnum, which covers all the internal and superior part of the joint; the second receives one from each of the three cuneiform bones: and the three following have each their particular dorsal ligament derived, either from the third cuneiform, or the dorsal aspect of the cuboides. After the division of these fibrous bandlets, the bones are still retained by much stronger and more compact bands; for, in addition to the plantar ligaments, there are interosseous fibrous masses filling the spaces which naturally exist between the lateral faces of the three cuneiform and corresponding metatarsal bones, the most important of which is that which we pointed out between the first cuneiform and the second metatarsal. It is indispensable to have a perfect knowledge of the arrangement of this ligamentary apparatus, and to divide it portion by portion, if we wish to avoid great difficulties and always serious tractions, when performing this operation. It must also be foreseen that in consequence of disease, or the advancement of age, the second metatarsal bone is sometimes ankylosed in the notch of the three cuneiform bones, thereby obliging us to have recourse to the saw; which Mr. J. Cloquet has proposed to establish as a general rule,* and which Mr. Hey has equally recommended. In subjects under fifteen years of age, the ossification being in general incomplete, so many precautions are unnecessary, because the instrument will readily cut through the

* *Nouveau Dictionnaire de Medecine*, article Amputation.

cartilages. Finally MM. Ziegler and Lisfranc have each met with the posterior tubercle of the fifth metatarsal bone prolonged so far towards the os calcis, that it represented a styloid process of six and eight lines in length applied upon the fibular side of the cuboides, so that in such cases it would have been difficult to penetrate into the joint by the external border.

It is easy to perceive that by amputating in this manner, we derive the very great advantage of preserving greater length and breadth to the foot; of retaining the termination of the tibialis anticus, tibialis posticus, peroneus brevis, and even of the peroneus tertius muscles; which is not less important in station and progression. By the ancient method, on the contrary, all these tendons are divided; the foot is much shorter; the arm of the lever into which the tendo Achillis is inserted, being the longest, the muscles of the calf have a constant tendency to draw the heel upwards and backwards, at the same time that the astragalus tends to luxate itself. The wound, besides, is much broader, and consequently its immediate re-union less easy and more uncertain.

Perhaps we will be accused of laying too much stress upon these different objects; but it seems to us that those who undertake the performance of operations, whether upon the dead body or the living will judge otherwise, and we think that in anatomy, and especially in surgery, it is much better to insist upon difficulties in order to overcome them, than to pass them over in silence feigning to despise them.

Finally, as all these bones are united by strong and numerous ligaments, and touch by plane surfaces, as they enjoy but a very obscure sliding motion, with the exception, however, of the astragalus which turns with considerable facility in the posterior cavity of the scaphoides, on the one part, and upon the superior articular surface of the calcaneum on the other: therefore, they are scarcely ever dislocated upon one another. Being very short and very thick, as well as of a soft and spongy texture, they are only susceptible of being crushed, and not of fracture by an indirect cause. Those of the metatarsus, however, appertain to the class of long bones, and as they represent a species of grating (*grillage*) or vault, the concavity of which is never exactly applied against the ground, they seem susceptible of being easily

broken in the different points of their length. Finally, the *ensemble* of their characters indicates their uses, viz. that every thing in the skeleton of the foot is for solidity, and scarcely any thing for mobility ; but if this disposition powerfully resists physical lesions, it is not the same with respect to vital alterations : thus, the numerous synovial membranes, the abundance of fibrous tissues, the spongy nature of these small bones, their dependent situation, and the pressure which they habitually support, all combine to favour the developement of acute or chronic inflammations, caries, necrosis, etc., affections, which so frequently have their seat in the solid parts of the foot. We will again have occasion to revert to the form of the metatarsal bones after having studied the plantar region.

The order of the superposition upon the dorsum of the foot is extremely simple, and we have already, as it were, pointed it out three times, when speaking of the ligature of the *arteria pedis*, of the amputation according to Chopart's method, and of that of M. Lisfranc. It will therefore be sufficient to note, 1st, the skin, thick and supporting a group of hairs before the instep, thinner and smoother externally and internally, still thinner anteriorly ; 2d. the subcutaneous layer, in which the saphenous veins and nerves ramify, as well as the superficial nerves of the dorsum of the foot ; 3d, the superficial sheet of the aponeurosis ; 4th, the tendon of the *tibialis anticus*, posteriorly and internally, those of the three *peronei* externally and posteriorly, those of the extensors of the toes, as well as the *extensor brevis digitorum* muscle, in the middle and throughout the whole extent of the region ; lastly, a part of the filaments of the deep nerves of the back of the foot ; 5th, the deep sheet of the aponeurosis ; 6th, the *arteria pedis* and its collateral veins, the external branch of the deep dorsal nerve ; 7th, the ligaments and bones.

Sect. 2. The Plantar or Inferior Region.

As the sole of the foot is not divided by the leg, it is of much greater length than the dorsal region ; on the one hand, it is prolonged backwards to the posterior extremity of the heel ; on the other, it advances almost an inch under the toes. The surface of this region is prominent before, behind, and in its external half :

in the middle and internally, it presents an excavation of greater or less depth into which the peronæo-calcaneal gutter falls, and which repeats, in part, the palm of the hand ; besides these, there are no other features worthy of fixing the attention of the surgeon.

CONSTITUENT PARTS.

I. *The Skin.*

In no part of the body does the skin present so great a degree of thickness as in the sole of the foot ; posteriorly, under the heel, this thickness is sometimes as much as two lines ; under the head of the metatarsal bones, it is a little less, and still less in the external half of the region ; in the plantar excavation, it gradually assumes the characters which distinguish it in the palm of the hand. It sometimes presents some few wrinkles, but otherwise affords no surgical interest. Smooth, regular, destitute of hairs and follicles, at least, the latter are imperceptible in the point first designated, it presents almost all the characters of the horny tissue. As this membrane forms a species of sole dense and inextensible, it is thereby well calculated for supporting the weight of the body, for resisting the inequalities of the ground, the action of foreign bodies, and for permitting man to habituate himself to walking without any artificial defence. Endowed with a very obtuse sensibility and its vital properties being but slightly developed, it seldom inflames ; cutaneous eruptions, boils, etc., scarcely ever form in it ; but hence, its maladies are difficult to cure ; its ulcers are very tedious in cicatrizing, and its wounds, with loss of substance, do not unite by the first intention, because we cannot approximate their divided edges. Tumours, abscesses, etc., which form beneath it, experience from it a considerable degree of resistance, are slowly developed, and produce excruciating pains ; finally, it is so tough, that instruments can scarcely incise it, and that it also prevents us, for a long time, detecting by the fluctuation the fluids which it covers. It is principally around the heel that those cracks and chilblains manifest themselves, which are so frequent in country people, at the approach of winter. We

might partly attribute these cause of the diseases to the peculiar organization of the integuments, if they did not equally make their appearance in the hands and even upon the dorsum of the foot.

II. *The Subcutaneous Layer.*

This is a complete cushion, elastic, fibro-adipose and of considerable thickness, differing from the corresponding palmar layer only in its still greater elasticity and its closer texture ; thus, it is formed by a vast quantity of strong and unyielding fibrous filaments, passing from the aponeurosis to the skin, which intersect and intermingle in an infinite variety of ways, in order to form a net-work or loculi in which the adipose vesicles are developed. Although this stratum encloses much fat, it varies but little in its thickness, which is about four or six lines under the posterior eminence of the foot, and which diminishes, in the other points, in proportion to the attenuation of the skin. Its very great elasticity performs an important part in station and progression ; it deadens the sensation which the pressure of the weight of the body would otherwise produce upon the integuments and soft parts of the sole of the foot. When it inflames, the insuperable resistance which it meets with from the skin, on the one side, and the aponeurosis on the other, causes the inflammation to be forcibly propagated towards the toes or heel ; and, as its texture is also very compact, very dense and fibrous, as well as vascular and cellular, the most intolerable pains, excessively serious symptoms, frequently a general reaction, and even death may be the consequences ; at least, they not unfrequently follow the introduction of a nail, splinter or some other pointed foreign body into the sole of the foot. It is, we are told, in consequence of such-like wounds that tetanus so frequently manifests itself among the inhabitants of Africa and America, who still retain the habit of walking bare-foot. The abscess, in which these inflammations terminate, may also form in a less perceptible manner, without giving rise to such severe suffering ; but then, even, they promptly produce extensive havoc and detach the skin with great rapidity, so that it is quite as necessary to make deep and long incisions in the commencement of these collections, as it is difficult to detect their existence.

III. *The Aponeurosis.*

When the preceding fatty cushion is removed, the sole of the foot seems to be divided into three prominent portions, which originate from the heel, and passing forwards become blended as they approximate the toes. These three prominences diverge, and represent pretty accurately the thenar and hypothenar eminences and the hollow of the hand ; that is to say, that one is continuous with the internal border of the foot, and includes a great part of the muscles which go to the first metatarsal bone and the great toe ; that another, supports the external border of the foot, and is formed by the muscular fasciculi which are inserted into the fifth metatarsal bone, and the little toe ; that the third, broader anteriorly, but narrower posteriorly than the two others, between which it is placed, extends from the middle of the heel to the base of the toes, and encloses principally the flexor muscles and tendons.

The plantar aponeurosis covers these three eminences, and although isolated in appearance, we may nevertheless say that it is confounded upon the sides with the dorsal aponeurosis, posteriorly and internally with the internal annular ligament of the tarsus, and that it arises from the posterior tuberosities of the inferior surface of the os calcis, as if from the expansion of the tendo Achillis. The portion which remains applied upon the internal muscular eminence is thin and almost entirely cellular ; so that, as it likewise corresponds to the great plantar notch, the phenomena which are attendant upon inflammations and deep-seated abscesses occurring in this situation, are very similar to those which are developed upon the thenar eminence, and wounds are generally much less dangerous here than in the rest of the region. That which covers the external eminence forms an extremely strong bandelet ; it is principally derived from the external and posterior tuberosity of the os calcis, and gradually becomes narrower in proportion as it advances ; so that at the posterior eminence of the fifth metatarsal bone, where it is inserted, in completing the arcade of the peroneus longus, it no longer forms but a cellular or fibro-cellular lamina, as upon the internal prominence ; nevertheless, internally, a distinct fibrous bandelet con-

tinues to run forwards, and becomes blended with the aponeurosis of the median eminence. The latter constitutes the plantar aponeurosis, properly so called ; it is triangular like the prominence which it covers ; posteriorly, where its apex is placed, it is very thick, and bears a greater resemblance to a tendon than a fascia, afterwards it gradually becomes thinner and broader, so that towards the middle of the length of the foot its fibres begin to separate, and soon form five distinct bandelets. These bands, which are moreover very irregular, continue to diverge, and each of them bifurcates upon arriving under the head of the metatarsal bones, for the purpose of giving passage to the flexor tendons of the toes, in the same manner as we have observed relatively to the palmar aponeurosis ; occasionally the bandelet of the little toe, as well as that of the first, are wanting ; which is owing to the transformation of the external and internal sheets into cellular tissue previous to their reaching the toes. On each side, and in its posterior half, this middle portion blends itself with the lateral portions, forming two partitions, the internal of which is fixed to the inferior surface of the first cuneiform bone, the scaphoides and astragalus, whilst the external is inserted into the crest of the cuboides, and upon the inferior face of the os calcis.

From what has preceded it follows, that each muscular eminence of the sole of the foot is contained in a canal which is half osseous and half fibrous, as far as the middle of its length, and that the most solid canal is that of the median eminence ; it also thence results that the muscles being thus bound down, act with much more energy and facility ; but what is of special importance to note, is that the fibres of this aponeurosis are so arranged as to leave, from space to space, small foramina, through which the subcutaneous cellulo-adipose tissue is continuous with the deep cellular texture ; by which, a means of communication is formed between the inflammations primitively developed in one or the other of these layers, and which also become a cause of acute pains by the strangulation of the inflamed corpuscles which traverse these apertures : in fine, we see, relatively to the aponeurosis, that inflammations and other deep-seated diseases of the sole of the foot, will be more dangerous and severe in proportion to their proximity to the heel, and the same will apply to the ope-

rations which we are sometimes obliged to perform upon this region.

IV. *The Muscles.*

Those of the tibial eminence represent in part the muscles of the thenar prominence. The *adductor* (abductor*) *pollicis pedis* is the most remarkable ; its fleshy mass originating from the internal and posterior tuberosity of the heel, on the one hand, and from the anterior border of the internal annular ligament of the tarsus, on the other, converts the vault of the calcaneum into a canal, and thereby protects the tendons, vessels and nerves which come from the leg to the foot ; it fills the osseous notch which separates the posterior tuberosity of the os calcis from that which is formed by the os cuneiforme magnum under the inner border of the foot. It is only opposite to this latter point that its tendon is isolated, and that it receives, upon its outer side, the fleshy fibres of the *flexor brevis pollicis pedis*, with which it is afterwards almost blended ; the latter then seems to replace anteriorly the fleshy portion of the preceding, which only exists posteriorly ; originating by means of a more or less elongated point under the scaphoides and cuneiforme magnum, the *short flexor* is much broader and thicker under the first metatarsal bone, of which it covers the whole internal surface, filling its cavity ; as it seems to bifurcate anteriorly, in order to become inserted with the tendon of the preceding, into the internal tubercle of the first phalanx of the great toe, and with the oblique abductor upon the internal tubercle of the same phalanx, a gutter is thereby formed which receives the tendon of the flexor longus pollicis pedis. As to the oblique and transverse abductors, their common attachment with the flexor brevis excepted, they are included entirely in the middle prominence.

The muscles of the external eminence are the *abductor* (adductor*) and *flexor brevis minimi digiti pedis* ; the fleshy portion of the first fills the osseous notch, which extends from the external and posterior tuberosity of the os calcis to the crest of the cuboides ; its tendon follows the external border of the foot, unites

* Of English Anatomists.

itself even to the posterior part of the fifth metatarsal bone, and goes to be inserted, enveloped as it is by the fibres of the flexor brevis, into the posterior and external extremity of the little toe. It is usually divided, in the commencement of the amputation, according to the method of M. Lisfranc. The second, which arises by a point from the inferior surface of the cuboides and of the last bone of the metatarsus, unites with the preceding tendon, and passes with it upon the posterior extremity of the same toe ; so that these two muscles bear a great resemblance to the two principal bundles of the internal eminence.

Lastly, the middle eminence includes,

(a) The *flexor brevis digitorum pedis, perforatus*, which repeats the flexor sublimis of the fore-arm, and which is the most superficial ; forming a single bundle in its posterior fourth, it divides, anteriorly, into four branches ; the four tendons which result from this division, after having bifurcated under the metatarso-phalangeal articulation, in order to give passage to the tendons of the flexor longus digitorum, are fixed upon the plantar aspect of the first phalanges. This muscle is so arranged that its principal action is upon the toes, and more or less upon the metatarsal bones.

(b) The *flexor longus digitorum* and *flexor longus pollicis pedis* are so situated in the calcien gutter, that the former is at first placed externally and the latter internally, but afterwards cross in such a manner that the tendon of the great toe glides beneath the other, in order to arrive at the inferior aspect of the short flexor tendon of the same appendage. That of the flexor longus digitorum, on the contrary, continues to run obliquely outwards as far as upon the superior surface of the flexor brevis communis ; it is there that it receives, upon its external border, the flexor digitorum accessorius, which arises from the external part of the inferior surface of the os calcis, and resembles a quadrilateral fleshy lamina, the direction of which is well calculated to overcome the obliquity of the action of the flexor longus communis. The four branches of the latter then separate, and giving origin to the lumbricales, pass onwards to their fibrous sheaths. Posteriorly, it is removed from the skin by the entire thickness of the adductor and flexor brevis muscles of the great toe ; anteriorly, it approximates so near to it that the subcutaneous layer alone is

between them ; immediately applied upon the bones in the first direction, it is afterwards separated from them by the interossei and the two abductor muscles of the great toe.

(*c*) Of the latter, the *oblique abductor** originates from the inferior surface of the second and third cuneiform bones, and is found almost confounded with the flexor brevis ; the *transverse abductor*† is placed horizontally under the head of the metatarsal bones ; but they are both inserted into the external side of the first articulation of the great toe ; consequently we conceive that they can approximate all the metatarsal bones to each other, increasing the concavity which is formed by this portion of the skeleton of the plantar region. The transversus pedis also separates the tendons of the lumbricales from those of the interossei.

(*d*) These last bundles (*interossei*) are situated between the bones of the metatarsus, and, as in the hand, are seven in number ; four to the dorsal region, two of which are for the second toe, and the other two, abductors, for the third and fourth ; three to the plantar region, adductors, for the last three toes. Upon the dorsum of the foot they do not rise above the level of the bones ; but upon the plantar surface, they form a greater or less prominence, according to their volume ; so that in the partial amputation of the foot, according to the method of M. Lisfranc, they enter into the composition of the flap.

(*e*) The tendons of the peroneus longus, tibialis anticus and tibialis posticus, also enter into this region ; the first extending obliquely from the posterior groove of the cuboides to the prominence formed by the root of the first metatarsal bone, is enclosed in a canal or theca, formed superiorly by the bones and inferiorly by ligaments or other fibrous processes ; so that it may act independently of all the others, and without obstacles, raising powerfully the external border of the foot outwards, at the same time that it greatly assists in the extension of this part of the limb. It, in fact, turns over a double pulley, in passing behind and beneath the fibular malleolus and upon the external border of the os cuboides. It is therefore of great importance to preserve it in operations.

* Flexor brevis pollicis pedis.

† Transversus pedis.

The second, an antagonist of the preceding, in relation to the extension and abduction of the foot, is remarkable, inasmuch as its insertion into the internal and inferior surface of the os cuneiforme magnum admits of its preservation in the tarso-metatarsal amputation, whereas by the operation of Chopart it is necessarily sacrificed.

Finally, the third, fixed upon the tubercle of the os scaphoides, after having passed under the small tuberosity of the calcaneum, is congenerous with the peroneus longus, on the one hand, but its antagonist on the other. We have already said that it concurs in the formation of a prominence which it is of importance to avoid mistaking for that of the scaphoides. In separating the foot, in the articulation of the two rows of the tarsus, we divide it; but as its adhesions under the astragalus and os calcis are preserved, its action remains the same; which is rather an inconvenience, since there is nothing on the side of the dorsal surface to counterbalance it.

We rapidly pass by the muscles of the sole of the foot, in general, because they have but very little relation with surgery. However, we will have occasion to revert to their relative disposition when we point out the order of superposition.

v. *The Arteries.*

There are only two which merit attention, the *plantaris interna* and *externa*, derived from the posterior tibial.

The first, much smaller than the other, soon divides into two branches, which run forwards, separated from the skin by the flexor brevis, and in such a manner that the internal plantar nerve, the tendon of the flexor longus pollicis, and even that of the flexor communis are situated between these two vessels. Unless from anomaly, the internal plantar is never so large, as to lead us to apprehend a serious hæmorrhage when it is wounded. Nevertheless, it almost uniformly requires one or more ligatures after the partial amputation of the foot.

The second, the actual continuation of the common trunk, taken near its origin, as it comes out from the calcien vault, first crosses the superior surface of the adductor muscle of the great toe, then that of the flexor brevis digitorum; so that if we make

an incision upon the groove which separates the internal from the middle eminence of the foot, we will find it external to and below the tendons which have passed behind the malleolus internus in their course to the toes. It continues to run obliquely outwards, until it corresponds to the external plantar groove, and has arrived opposite to the posterior extremity of the fifth metatarsal bone; and, in this track, it is found above the flexor brevis, on the outer side of the external plantar nerve, below the flexor digitorum accessorius muscle, the calcaneo-cuboid ligament and the tendon of the peroneus longus muscle. Then, of the two branches into which it divides, one continues on in the same direction, becomes more superficial, and ramifies in the flexor brevis minimi digiti muscle and in the subcutaneous cushion; the other turns inwards, runs slightly forwards and gains the posterior part of the first interosseous space; so that the flexor brevis and longus digitorum, as well as the lumbricales are below it, whilst the tendon of the peroneus longus, the ligaments, and even the origin of some of the interossei are above, the oblique abductor of the great toe behind, and the transverse abductor before. It is there that it unites with the arteria pedis, and that the plantar arch, as it is called, terminates; an arch which unites the anterior and posterior tibial arteries in a great loop, the apex of which is in the popliteal space, and its base in the sole and back of the foot; so that a ligature applied upon any point whatsoever of either of these branches, would not prevent the blood from re-appearing in the part below the thread, as it will be conveyed there by the opposite branch of the loop. Therefore, it is a rule, especially in wounds of the anterior tibial artery, to tie both of the divided extremities of this vessel. Does not this disposition equally indicate that, in order to cure an aneurism of one of the principal arteries of the leg, it would be much better to operate according to the ancient method than by the new? Be this as it may, after the partial amputation of the foot, the external plantar artery is the first which must be tied, and we may observe that, by the method of M. Lisfranc, it is possible to avoid this trunk, but that then the inferior interosseous branches, or those which are given off from its convexity, will frequently require each a ligature.

VI. *The Veins.*

Accompanying the arterial branches, they do not present any peculiarity in their distribution which is not related to that of the latter. As there is no regular trunk found in the subcutaneous layer, and as the small veins have no very essential relations with surgery, we need not dwell upon them any longer.

VII. *The Lymphatics.*

Those of the superficial layer are very numerous. They communicate with the lymphatics of the dorsal region at the borders of the foot, and enter the regions of the leg by passing behind the two malleoli. Those of the deep-seated plane are less numerous and follow the blood-vessels, passing with them through the calcien groove; so that inflammatory diseases of the skin and of the cushion which separates it from the aponeurosis, are easily transmitted, by the former, to the dorsum of the foot, and to the outer as well as the inner side of the leg; whilst the second can only propagate the affections of the deep-seated parts into the posterior tibial region.

VIII. *The Nerves.*

They are all derived from the posterior tibial. Before it bifurcates in order to produce the two plantar nerves, it usually gives off a considerable number of filaments, which generally originate from the trunk by a single branch, ramify in the subcutaneous layer of the internal part of the heel, and concur in rendering inflammations, which are developed in this situation, very painful. The two plantar nerves, at first mingled with the tendons of the flexor muscles and tibialis posticus, soon diverge and follow different directions.

The internal runs, as we have already said, between the two branches of the corresponding artery, and upon a plane a little more superficial; it crosses the inferior surface of the tendons of the flexor digitorum and flexor longus pollicis, previous to getting under the flexor brevis pollicis pedis; then it lies much

nearer the integuments, and its distribution is similar to that of the branches which the median gives to the thumb.

The external also follows the artery, upon the concave or internal side of which it is always found situated. From its convexity it gives off a pretty great number of small branches which cross this vessel, in order to penetrate and ramify in the external muscular mass, and the elastic cushion which this part supports. At length, diving with the arteries, it terminates in the foot, in the same manner as the median in the hand ; thus we see that, by their position, the nerves of the plantar region will always be wounded before the arteries are touched. From their volume and the numerous twigs which they give to the subcutaneous layer, we may also have an idea of the violence of the neuralgic pains which sometimes manifest themselves in the sole of the foot, as well as those which accompany all acute inflammations of this region.

IX. *The Skeleton.*

HAVING examined very much in detail the bones of the tarsus and their numerous articulations, in the dorsal region, we have now only to describe the disposition of the concavity which the inferior surface of the skeleton of the foot presents. In fact, during station, the heel, the head of the metatarsals and the external border of the last of these bones, are the only parts which rest upon the ground ; so that the weight of the body, transmitted by the leg upon the superior surface of the astragalus, makes a constant effort to efface this curvature. Besides, as it is much deeper internally than externally, it thence follows that in cutting the flap in the soft parts, for the partial amputation, we must necessarily, in order to give it sufficient thickness, raise the knife against the tibial border, and the more so, the nearer the operation is performed to the tibio-tarsal articulation. On the other hand, as this great excavation encloses the vessels, nerves and the most important of the soft parts, it preserves them from pressure, and permits the foot to accommodate itself better to the inequalities of the soil ; therefore, those in whom this concavity is less developed, are soon fatigued by walking or standing ; it likewise is the cause that the calcaneum, prolonged very much backwards,

pressed from above downwards by the leg, and drawn from below upwards by the tendo Achillis, may be broken by the muscular action. From the power of the muscles of the calf, one would suppose that when this rupture occurs, the posterior fragment will be pulled very much upwards; but the plantar aponeurosis and the fibrous layers firmly oppose it, and most frequently, the displacement is scarcely perceptible. As for the rest, this fracture resembles, in many respects, that of the patella or olecranon.

When the cuboides and scaphoides are separated from the calcaneum and astragalus, a surface exists, the transverse plane of which is oblique from above downwards, and from within outwards. This plane, which is thicker internally than externally, is about two inches and a half in height, and consequently requires a considerable flap which must extend almost as far as the root of the metatarsal bones. In the tarso-metatarsal amputation, as the thickness of the bones diminishes in a pretty regular manner, from the first cuneiform towards the outer border of the foot, it is necessary that we should give greater length to the flap internally than externally. But as the metatarsus is naturally longer on the tibial side, it follows that it suffices to terminate the section of the soft parts at an equal distance from all the toes: that is to say, under their posterior extremity, always taking care to round off the angles of the flap a little, in order that its form and length may correspond to the surfaces against which we are to apply it. It should also be noted, that in sliding the instrument flatwise between the skeleton and the flesh, the concavity of the bones readily admits of its being conducted as far as their phalangeal bulging, but that then, it will be necessary to depress the edge of the instrument very considerably, in order to terminate the incision.

The metatarsal bone of the great toe being very much expanded at its two extremities, and thereby rendered very concave upon its internal and inferior surfaces, certain rules of practice are deducible from it, which it is useful to be made acquainted with. Thus, even when the toe which it supports is alone disorganised, we do not amputate in the first metatarso-phalangeal articulation, but we prefer dividing the bone, under consideration, in a sloping direction, through the posterior part of its

body. On the other hand, even when this first metatarsal bone is diseased, we should not, unless in a case of absolute necessity, disarticulate it behind, because the first cuneiform bone would form a considerable projection, which would be very troublesome upon the inner border of the foot, after the cure is completed.

In relation to the methods which may be adopted in the performance of this operation, the dorsal surface of the bone being covered only by the skin, it is evident that the flap must be formed at the expense of the soft parts of the plantar region ; so that we may here apply what was said of the metacarpal bone of the thumb ; excepting that, as the former metatarsal is almost immoveable, and as we are not treating of a simple disarticulation, but of an oblique section in the continuity of this bone, the method which consists in cutting, in the first place, the muscles from before backwards, between the first two toes, in order to detach, in the next place, the internal flap, after having sawed the bone, would present no advantage, and the two others, which were indicated for the thumb, are almost the only ones which we should employ. When every thing is naturally disposed, it seems to us that we should give the preference to that method which consists in commencing the formation of the flap, by traversing the tissues from the dorsal towards the plantar surface. In this case, however, it is always indispensable to push the soft parts inwards, so that they may pass as much as possible beyond the internal border of the foot, in order that the flap may have a proper thickness ; in the second place, we should plunge the bistoury at first perpendicularly upon the middle of the superior surface of the bone, so as to be able to draw the skin upon a line with its internal border, with the instrument, which we then incline in such a manner as to make it slide upon the internal and inferior aspect of the bone which we wish to remove ; that is to say, by directing it from above downwards and from within outwards ; lastly, it is also necessary that the bistoury should follow the concavity of the bone, and that the flap be prolonged beyond the metatarso-phalangeal articulation. With respect to the last metatarsal bone, it may be easily removed by either of the processes directed for the disarticulation of the little finger, together with such modifications as the prominence formed posteriorly and

externally by its posterior tubercle may require. On this subject, we may examine the *Mémoire* of M. Lisfranc, and that which M. Mirault, of Angers, has recorded in the *Archives générales de Médecine*.* All of the metatarsal bones may be amputated, like those of the metacarpus, in their continuity, under the same circumstances and by the same processes.

If we now take up the order of superposition, we will find, 1st, the skin, extremely thick and dense under the heel, very thick likewise under the external border and anterior extremity of the metatarsus, but thin and supple in the plantar excavation; 2d, the subcutaneous layer, elastic, dense and compact, the thickness of which is in proportion to that of the skin, and scarcely varies according to the obesity or emaciation of the individuals; 3d, the aponeurosis, very thick posteriorly, especially upon the median and external muscular eminences, much thinner anteriorly and upon the internal muscular prominence, with parallel fibres, and diverging from the heel towards the root of the toes, divided as it were, into three portions by the two septa which it sends between the three muscular eminences, and preserving pretty firm adhesions with the cellulo-adipose cushion; then, upon the same plane, we find, 4th, internally and posteriorly, the adductor muscle of the great toe; in the middle, the flexor brevis digitorum, and externally the abductor minimi digiti pedis; 5th, anteriorly and internally, the tendon of the flexor longus pollicis, the branches of the internal plantar nerve and artery, and the flexor brevis pollicis; in the middle, the same muscle still, the tendons of the flexor longus communis, and the digital branches of the external plantar nerve; externally, the flexor brevis minimi digiti, and one of the branches of the external plantar artery; 6th, upon another plane and in the median region, the external plantar artery and nerve posteriorly, the accessory muscle of the flexor longus digitorum, the tendon of the latter and of the flexor longus pollicis, with the external plantar vessels and nerves; still further forwards, the four tendons of the flexor longus communis and the lumbricales; 7th, the oblique and transverse abductor muscles of the great toe, the portion of the arterial and nervous arches of the sole of the foot; 8th, the plantar interossei muscles; 9th,

* Juin, 1824.

and lastly, the skeleton, hollow, uneven, rugged, covered with ligaments, and including, in the tarsal portion, the four dorsal interossei muscles, which are traversed in their posterior extremities by the arteriæ perforantes.

Sect. 3. Of the Toes.

The absolute length of these appendages regularly decreases from the first to the last, and if the free extremity of the second passes beyond that of the others, it is because the metatarsal bone which supports it is actually the longest. They naturally occupy the same level: but in consequence of the transverse pressure which shoes exercise upon them, the second occasionally escapes, if I may so say, from between the others, in such a manner as to surmount and remain above them. This disposition is particularly observed in persons who naturally have a broad foot, or who are in the habit of wearing narrow shoes. It may become the cause of very acute pain, in consequence of the severe compression of the dorsal surface of this toe during progression, and so much so, that surgeons have been solicited to amputate this organ, although not affected by any malady.

The dorsal aspect of the toes, which resembles, under almost all its relations, the dorsal surface of the fingers, differs from it only inasmuch as the convexity which it forms upon the bodies of these appendages is never effaced, whatsoever may be the nature of the movement, and because, in uniting with the foot, it concurs in the production of a transverse excavation of greater or less depth, instead of forming a saliant angle, during flexion, with each metatarsal bone. In fact, this dorsal groove is always superficial in the hand, and exists only when the fingers are forcibly extended, whilst in the foot, the greatest flexion of the toes can scarcely make it disappear: This difference, depends, on the one hand, upon the phalangeal extremity of the metatarsal bones sinking more upon the plantar surface than that of the metacarpals upon the palmar surface; on the other, upon the very great thickness of the subcutaneous plantar layer, which firmly elevates the first phalanx of the toes; finally, it may also be attributed to the functions of these appendages, which, receiving at every step the weight of the body, are thereby constantly repelled towards the

the dorsal surface. As for the rest, the inter-line of their metatarsal junction is generally met with about eight lines behind their commissures. With respect to the other articulations they are of no utility in surgery, because, if the amputation of a toe becomes necessary, the reasons which require us to preserve the phalanges of the hand not existing in the foot, we prefer removing them entirely; so that we will say nothing of the folds of the skin which covers them.

As the toes are constantly pressed against each other, they are consequently more or less flattened laterally; but as this flattening does not change the form of the phalanges, which are broadest transversely, a painful compression often results from it opposite to the articulations, which explains the origin of a great number of corns.

The little toe being, from its position, most exposed to the pressure of the shoe, against which it exercises slight friction during progression, it is therefore the most frequently affected with corns; indeed there are few persons who are free from them upon the dorsal and external surface of this toe. They are formed by the application of a greater or less number of epidermic plates upon each other, and are removed by softening them in any manner whatever.

The plantar surface of the toes is remarkable, first, for the deep transverse or semilunar groove which divides it into two portions. In the bottom of this groove, which is owing to the subcutaneous elastic cushion bulging very much under the second phalanx (*phalangette*), and to that of the sole of the foot advancing from nine to twelve lines upon the inferior aspect of the first phalanx, we find a dense and slightly extensible, but delicate and pretty thin skin; so that, if we endeavour to obliterate or diminish this groove, as happens in the action of climbing a tree, for example, this skin frequently tears, and small but very painful fissures are the consequence. The posterior eminence terminating anteriorly by a convex semilunar border, and being only a prolongation of the sole of the foot, it follows that in disarticulating all the toes by their dorsal surface, we may remove them together, forming a single flap under their plantar surface, a flap which is besides very thick and of a sufficient length to cover exactly the metatarsal heads. It is true that an opportunity for performing

such an operation must be rare, because it should only be resorted to when all the toes are disorganized at the same time. Now an alteration carried to this degree does not limit itself to the toes; it usually comprises a more or less extensive portion of the metatarsus; but they may mortify from congelation; a burn may involve their anterior half, which may also be crushed by the wheel of a carriage, etc. Consequently, this amputation, in totality, proposed by M. Lisfranc, is applicable to the foot as well as to the hand, although less frequently; and no person will dispute its advantage over the successive amputation of all these appendages, the one after the other.

When only one toe is diseased, we separate it from the metatarsus in the same manner as was directed for the fingers, since the anatomical disposition is similar; however, as the head of the metacarpal bones makes a prominence which we may render considerable and angular, by flexing the first phalanx, whilst the corresponding part of the bones of the foot, is rather found in a depression, we are obliged, in order to find the joint, when we operate upon the latter appendage, to have recourse to the known distance of the commissure, instead of referring to the osseous eminences. On the other hand, the bones of the metatarsus diminishing gradually in volume, from the tarsus towards the toes, and remaining flattened upon the sides of their anterior extremity, instead of bulging out like the metacarpal bones, it follows that we can have no motive for amputating in the continuity of a metatarsal, when the disease is confined to the toe only. We must make an exception however relatively to the first, the posterior articulation of which bulges so much, that surgeons have for a long time considered, that it was infinitely better to amputate behind it, by sawing the bone very obliquely from behind forwards, than to limit themselves to its simple disarticulation.

The anterior pulpy expansion of the plantar portion of the toes being of a softer texture and more rarefied than the corresponding part of the free extremity of the fingers, its inflammations are attended with less pain, and are generally of a phlegmonous character, often terminating by suppuration. Notwithstanding the toes include the same elements and present the same characters as the fingers, they are, nevertheless, much less liable to those inflammations which are known by the name of

whitlow, and the symptoms which accompany them, when they do occur, are far less severe.

The circumference of the nail is equally sometimes the seat of *tournioles*, and it is particularly to these superficial or deep-seated inflammations of the environs of the nails that the name of *onychia* or *paronychia* has been given. But of late, some have wished to attach this title to that form of ulceration which we observe most frequently in the immediate vicinity of the nail of the big toe. This disease, which is uniformly produced by what we call the *growth of the nail into the flesh*, must be carefully distinguished from that which Wardrop has described by the name of *onychia maligna*; it is produced by the pulp of the great toe being pressed by shoes from below upwards and upon the sides, ascending upon the dorsal surface of the horny plate, the edges of which then appear to be buried in the soft parts, a phenomenon which is also favoured, says Mr. Richerand, by the habit which many persons have, of keeping the nail of this toe very short and especially of rounding off its angles. However, as the pressure on both sides is not equal, only one of the edges of the plate is generally buried, and according to most surgeons, the ulceration is most frequently observed on the inner, whereas Guillemot says the outer side.

Be this as it may, anatomy indicates that the disease may sometimes be removed by insinuating some lint under the edge of the nail which produces the ulceration, in order to elevate it, at the same time that the ulcerated flesh is found repelled, in the opposite direction, by the pressure which it experiences; it also indicates that for this treatment, recommended by J. Fabrice, we may advantageously substitute the steel plate proposed by Desault, or the sheet of lead advised by M. Richerand. But it is evident, that by excising the vegetations, and afterwards repeatedly cauterising them with the lapis infernalis, thereby favouring the formation of a very solid cicatrix as advised by M. Breschet of Lyons, we obtain a more speedy and effectual cure, because it is not the nail which has enlarged in order to wound the skin, but the soft parts which have been pressed against its edges. Another still more certain and prompt measure is that which consists in the extirpation of the nail; but it is proper to note that the intimate adhesion of this plate of the dorsal surface of the last phalanx as well as the encasing of sit

root and edges in the skin, render this operation excessively painful. If, however, we take the precaution to make a perpendicular incision half a line or a line behind the root of this production, we open what M. Dupuytren calls the *matrix* of the nail; then, whether we wish to remove it entirely, or only its external or internal half after having made a longitudinal division of it into two equal parts, by thrusting one blade of the scissors rapidly from its free edge and under the nail to its root, we experience much less difficulty, and the pain is far less excruciating, because by this means, a great part of the adhesions are destroyed before-hand.

Finally, so far as the skin, subcutaneous layer, fibrous sheaths, tendons, synovial membranes, vessels and nerves are concerned, as these different elements are disposed in a very similar manner to those of the fingers, we think that we must refer, for more ample details, to the article which treats of these latter organs.

EXPLANATION OF THE PLATES.

VOL. II.

PLATE VII.

This Figure represents the Iliac Region, the Inguinal Region, and a part of the Pubic Region, viewed from the exterior and covered by their aponeuroses.

- 1 1 1 1 Aponeurosis of the obliquus externus.
- 2 2 Poupart's ligament, continuous below with the falciform process of the fascia lata.
- 3 3 Inferior and external *bandelets* of the abdominal aponeurosis, which fall upon the superior border of Poupart's ligament, in order to concur in the formation of the external pillar of the ring.
- 4 Anterior and superior spinous process of the ilium.
- 5 5 5 5 Circumference of the inguinal ring.
- 6 Internal pillar of the ring.
- 7 External pillar of the ring.
- 8 8 8 Spermatic cord.
- 9 9 9 Flethy loops of the cremaster muscle.
- 10 Pubic or external extremities of the loops of the cremaster.
- 11 Superior or internal extremities of the same muscular loops.
- 12 12 *Bandelets* of the aponeurosis of the external oblique, which separate in order to give passage to the spermatic cord, and to form the inguinal ring.
- 13 13 The space which these two *bandelets* leave between them previous to constituting the ring properly so called.
- 14 Spermatic branch of the genito-crural nerve.
- 15 Root of the penis.
- 16 Body of the femur.
- 17 17 Section of the thigh below the inguinal region.
- 18 18 18 18 Oval aperture of the fascia lata, for the passage of the superficial veins.
- 19 19 19 Branches and trunk of the internal saphena vein.
- 20 Femoral artery.
- 21 External pudic vessels.
- 22 Portion of adipose tissue, preserved in order to support the superficial epigastric veins and artery.
- 23 A branch of the crural nerve.
- 24 24 24 Lymphatic glands.

PLATE VIII.

This Figure represents the same parts as the preceding, but in such a manner that the aponeuroses, incised in different points, expose to view the organs which they cover, and especially the epigastric and crural vessels in their relations with the spermatic cord, Poupart's ligament and the fascia lata.

- 1 1 1 1 Abdominal aponeurosis.
- 2 The Penis.
- 3 3 3 3 Femoral aponeurosis.
- 4 4 Ilio-pubic ligament, straighter than in the natural state, because the fibrous laminæ of the abdomen and of the thigh are detached from it.
- 5 Anterior and superior spinous process of the ilium.
- 6 6 6 Spermatic cord.
- 7 7 Aponeurosis (*tendon*) of the external oblique reflected.
- 8 8 Flap of the internal and transversalis, likewise reflected.
- 9 9 Portion of the fascia transversalis raised upon the abdominal aspect of the transversalis muscle.
- 10 10 *Fascia propria*, or the cellular layer which invests the peritoneum, and is continued upon the spermatic cord.
- 11 11 Crural (femoral) artery.
- 12 External circumflex and superficial muscular artery originating a little lower than usual.
- 13 13 Epigastric artery. (We must observe that, in this figure, the superior part of the thigh is in forced extension, in order to expose to view that portion of the crural arch under which the vessels pass).
- 14 Common trunk of the external pudic and superficial epigastric arteries divided.
- 15 Origin of the deep femoral artery.
- 16 Pubic and obturatrix branch, arising by a common trunk from the epigastric.
- 17 Trunk of the anterior (*circumflex*) iliac artery.
- 18 Lymphatic gland which closes the abdominal orifice of the crural canal.
- 19 Crural (femoral) vein.
- 20 Termination of the internal saphena vein.
- 21 21 21 Internal saphenus nerve, detached from the crural in the iliac fossa, and passing before the circumflex iliac artery and upon the external side of the femoral artery.
- 22 22 22 22 The aponeurosis slit open affording a view of the femoral vessels and nerves below the inguinal region.
- 24 24 24 24 24 24 Limits of the superficial sheet of the fascia lata; this sheet being removed in order to expose the vessels, the sartorius muscle and the deep fibrous layer.

- 25 25 25 25 Circumference of the superior crural ring, divided into two unequal portions by the passage of the femoral artery.
 26 26 Sartorius muscle, resting upon the deep sheet of the aponeurosis.

PLATE IX.

This Plate, which represents the interior of the great and of the small pelvis, is disposed in such a manner that, on one side, the peritoneum and the iliac and transverse aponeuroses are removed, whilst, on the opposite side, these laminæ are in place. It is moreover cut horizontally, in the direction of the sub-umbilical line, so as to expose to view the internal face of the hypogastric region

- 1 External inguinal fossette, corresponding to the posterior aperture of the inguinal canal.
 2 Middle inguinal or femoral fossette.
 3 3 Internal inguinal or vesical fossette.
 4 Spermatic vessels concealed by the peritoneum.
 5 Epigastric artery, *idem*.
 6 Urachus, or prolongation of the bladder, *idem*.
 7 7 7 The bladder itself, in its natural state and mantled by its serous membrane.
 8 8 8 Recto-vesical excavation.
 9 9 Flaps of the peritoneum reflected.
 10 Anterior wall of the iliac fossa.
 11 11 11 Posterior wall of the iliac fossa, covered by the fascia iliaca, and divested of the peritoneum.
 12 12 The rectum.
 13 Termination of the aorta.
 14 Primitive iliac artery.
 15 15 External iliac artery.
 16 16 Internal iliac artery.
 17 Umbilical artery.
 18 18 Epigastric artery.
 19 Pubic branch of the epigastric artery.
 20 Obturatrix branch of the epigastric.
 21 21 Circumflex iliac artery.
 22 Vena cava.
 23 External iliac vein.
 24 Artery given off from the epigastric, and which enters the crural canal.
 25 25 Spermatic vessels enveloped in the fascia propria.
 26 Ureter
 27 27 Vas deferens.
 28 Obturator nerve.
 29 29 Genito-crural nerve.
 30 Spermatic branch of the preceding nerve.
 31 External inguinal fossette.

- 32 Middle inguinal fossette.
 33 33 Psoas magnus and psoas parvus muscles.
 34 34 Iliacus internus muscle.
 35 35 35 35 Transversus and obliquus internus abdominis muscles.
 36 36 Recti abdominis muscles.
 37 37 37 37 Iliac crests or spines.
 38 38 Portion of the vertebral column.
 39 Arteria sacra media.
 40 40 40 40 Section of the hypogastric zone.

PLATE X.

Ano-Perineal Region.

- 1 1 Trunk of the internal pudic artery.
 2 Inferior branch of the internal pudic artery.
 3 Superior, *idem* *
 4 Inferior hæmorrhoidal artery.
 5 5 5 Superficial artery of the penis and of the septum.
 6 Transversus perinæi artery, or bulbo-urethral.
 7 7 7 Inferior hæmorrhoidal vessels.
 8 Trunk of the internal pudic, seen through the aponeurosis.
 9 Pudic Vessels coming out from the ischiatic notch.
 10 Gluteal Vessels.
 11 11 Internal pudic nerve.
 12 Anal aperture of the rectum.
 13 13 Circular fibres of the Sphincter ani muscle.
 14 14 14 14 Elliptical fibres of the Sphincter.
 15 Accelerator urinæ muscle, not covered by the aponeurosis.
 16 16 Erector penis muscle, *idem*.
 17 17 Transversus perinæi muscle, divided into two bundles, which are separated, in order to show the bifurcation of the internal pudic artery.
 18 18 Levator ani muscle.
 19 19 19 19 19 19 Section and flaps of the glutæus maximus.
 20 Portion of the glutæus medius.
 21 21 21 Ischio-bulbar triangles, in which the incision should be made when we penetrate into the bladder by the lateralized method.
 22 22 Accelerator Urinæ muscle covered by the aponeurosis.
 23 23 Erector Penis muscle covered by the aponeurosis.
 24 The apex of the coccyx.
 25 25 Great sacro-sciatic ligament.
 26 26 26 Piriformis muscle.
 27 28 Tuberosities of the Ischium.

* No. 3 should have been placed (in the plate) where the pudic artery is just emerging from the slit in the transversalis perinæi muscle; the superior branch of the internal pudic being indicated by the dotted line there commencing.—*Transl.*

- 29 Obturator internus muscle.
 29 (bis.) Flap of Skin reflected.
 30 30 30 30 Skin preserved upon the buttocks.
 31 31 31 Ischio-rectal excavation, the aponeurosis being preserved.
 32 32 32 32 *idem.* the aponeurosis being removed.
 33 33 The Urethra uniting with the corpus cavernosum.

PLATE XI.

Ano-Perineal Region.

In this plate, the pelvis is viewed laterally, and from its perineal aspect, the ischium is saved through immediately below the ischiatic spine, and its pubic ramus below the symphysis, in order to expose the relations of the rectum, of the prostate, of the bladder and of the origin of the urethra.

- 1 Thin skin which penetrates into the anus.
- 2 Bulb of the Urethra.
- 3 Prostate.
- 4 Vesicula seminalis.
- 5 Cowper's Gland.
- 6 Membranous portion of the urethra.
- 7 The Rectum.
- 8 8 8 Sphincter of the anus.
- 9 9 Circular fleshy fibres which surround the anus.
- 10 Wilson's muscle.
- 11 Right root of the corpus cavernosum covered by its muscle.
- 12 Left root of the corpus cavernosum divided by the same stroke of the saw which divided the ramus of the pubis and reflected under the urethra.
- 13 13 13 Muscles of the buttock divided.
- 14 Great sacro-sciatic ligament.
- 15 The same reflected.
- 16 Lesser sacro-sciatic ligament.
- 17 Tuberosity of the ischium.
- 18 Coccyx.
- 19 Section of the ischium below its spine.
- 20 " " descending branch of the pubis.
- 21 Cotyloid cavity.
- 22 Ischiatic vessels.
- 23 Internal pudic vessels.
- 24 Hemorrhoidal artery of the pudic.
- 25 Artery of the bulb.
- 26 Superficial (Dorsal artery of the penis) and artery of the septum.
- 27 Crural artery coming out of the pelvis.
- 28 Crural vein, *idem.*
- 29 Crural nerve, *idem.*
- 30 Portion of the rectum which deviates posteriorly.
- 31 Muscular parts of the divided thigh.

- 32 32 Portion of the skin preserved upon the buttocks.
 33 Flap of the tendon of origin of the muscles which are attached to the tuber ischii.
 34 34 34 Superior border of the Obturator foramen.
 35 Great sciatic nerve.

PLATE XII.

View of the interior of the Pelvis from a perpendicular section.

- 1 The bladder reflected from left to right and from above to below the pelvis.
 2 Portion of the rectum, *idem.*
 3 Internal part of the left thigh.
 4 The prostate gland.
 5 Vesicula seminalis.
 6 6 Vasa deferentia.
 7 7 Ureter.
 8 8 8 Pelvic Aponeurosis.
 9 Pelvic orifice of the sub-pubic (*Obturator*) canal.
 10 Obturator Nerve.
 11 Obturator vessels coming from the epigastrics.
 12 Fossette which exists on the outer side of the crural vessels.
 13 Epigastric vessels.
 14 Abdominal orifice of the inguinal canal, which separates the fascia transversalis into two portions.
 15 Spermatic vessels.
 16 Vas deferens, entering into the inguinal canal.
 17 17 17 Fascia transversalis supported by hooks.
 18 18 Poupart's Ligament, which continues the arch formed in the first place by the iliac crest (*spine of the ilium*).
 19 Fossa Iliaca.
 20 Psoas muscle.
 21 21 21 Ischiatic arcade of the pelvic aponeurosis.
 22 22 22 Nerves of the sacral plexus.
 23 Termination of the aorta.
 24 Primitive Iliac artery.
 25 External Iliac.
 26 26 Internal Iliac.
 27 Gluteal artery.
 28 Ischiatic artery.
 29 Internal pudic artery.
 30 Umbilical artery reflected inwards.
 31 31 External iliac vein.
 32 Sacral canal laid open.
 33 Section of the Symphysis pubis.
 34 Perpendicular section of the Sacrum.
 35 Rectus abdominis muscle.

PLATE XIII.

- 1 1 The penis drawn up towards the abdomen, as in catheterism
- 2 2 Interior of the bladder.
- 3 3 Section of the Prostate.
- 4 Interior of the Prostatic portion of the urethra.
- 5 External surface of the membranous portion of the same canal.
- 6 Bulbous portion of the canal.
- 7 Bulb of the urethra.
- 8 Right root of the corpus cavernosum, cut and raised against the penis.
- 9 Right vesicula seminalis depressed on the outer side of the rectum.
- 10 10 Vas deferrens of the same side, uniting with the vesicula seminalis in order to enter into the prostate.
- 11 Section of the body of the pubis external to the symphysis.
- 12 12 Rectum seen on the right side.
- 13 Vesico-pubic fossette usually filled with cellular tissue, and which must be traversed in the hypogastric lithotomy in order to arrive at the bladder.
- 14 14 Hypogastric portion of the abdominal paries preserved.
- 15 Anterior vesical excavation, lined by the peritoneum which is here very much elevated by the distended bladder.
- 16 Superior part of the recto-vesical excavation.
- 17 Anus.
- 18 18 Perpendicular section of the soft parts of the perineum.
- 19 Portion of the aorta and vena cava.
- 20 20 Vertical Section of the sacrum, but externally and to the right of the median line, on which account the rectum has not been divided.
- 21 Handle of the Catheter. Here this instrument is much more curved than usual, in order to separate the middle portion of the urethra from the groove which the inferior surface of the corpora cavernosa presents for it.
- 22 Free extremity of the catheter in the bladder.
- 23 Handle of the *lithotome caché*.
- 24 The sheath of the *lithotome* disengaged from the groove of the catheter, and in the position which it is necessary to give it, by applying it a little more against the pubis, in order to open the prostate and the origin of the urethra.
- 25 Cutting blade of the *lithotome* sprung from its sheath.
- 26 26 Incision of the integuments in the lateralized lithotomy.
- 27 Skin and other soft parts which envelope the penis, dissected and turned aside.
- 28 28 Vertical section of the bladder and of the prostate, but in such a manner that the right third only of these parts has been taken away.

PLATE XIV.

This Design represents the most important parts of the Ham or of the Popliteal Region.

- 1 1 1 Limits of the femoral triangle of the Region.
- 2 2 2 Popliteal hollow, and posterior face of the femur.
- 3 3 3 Limits of the tibial triangle, of the popliteal space.
 - 4 Semimembranosus muscle.
 - 5 Semitendinosus muscle.
 - 6 Sartorius muscle.
 - 7 Gracilis muscle.
 - 8 Biceps femoris muscle.
 - 9 Gemelli muscles.
- 10 10 Popliteal Artery.
- 11 11 Popliteal vein.
 - 12 Termination of the great sciatic nerve.
- 13 13 Internal Popliteal (*Tibial*) nerve.
- 14 14 External Popliteal (*Fibular*) nerve.
- 15 15 15 Superior articular vessels.
- 16 16 Inferior articular vessels.
 - 17 External Saphena vein reflected outwards.
- 18 18 Hooks which draw outwards the gemelli muscles in order to expose to view the vessels and nerves in the tibial triangle
- 19 19 19 Parts of the thigh and leg, still covered by the skin.
- 20 20 20 Teguments reflected from the popliteal region.

Inguinal.

PL. 7

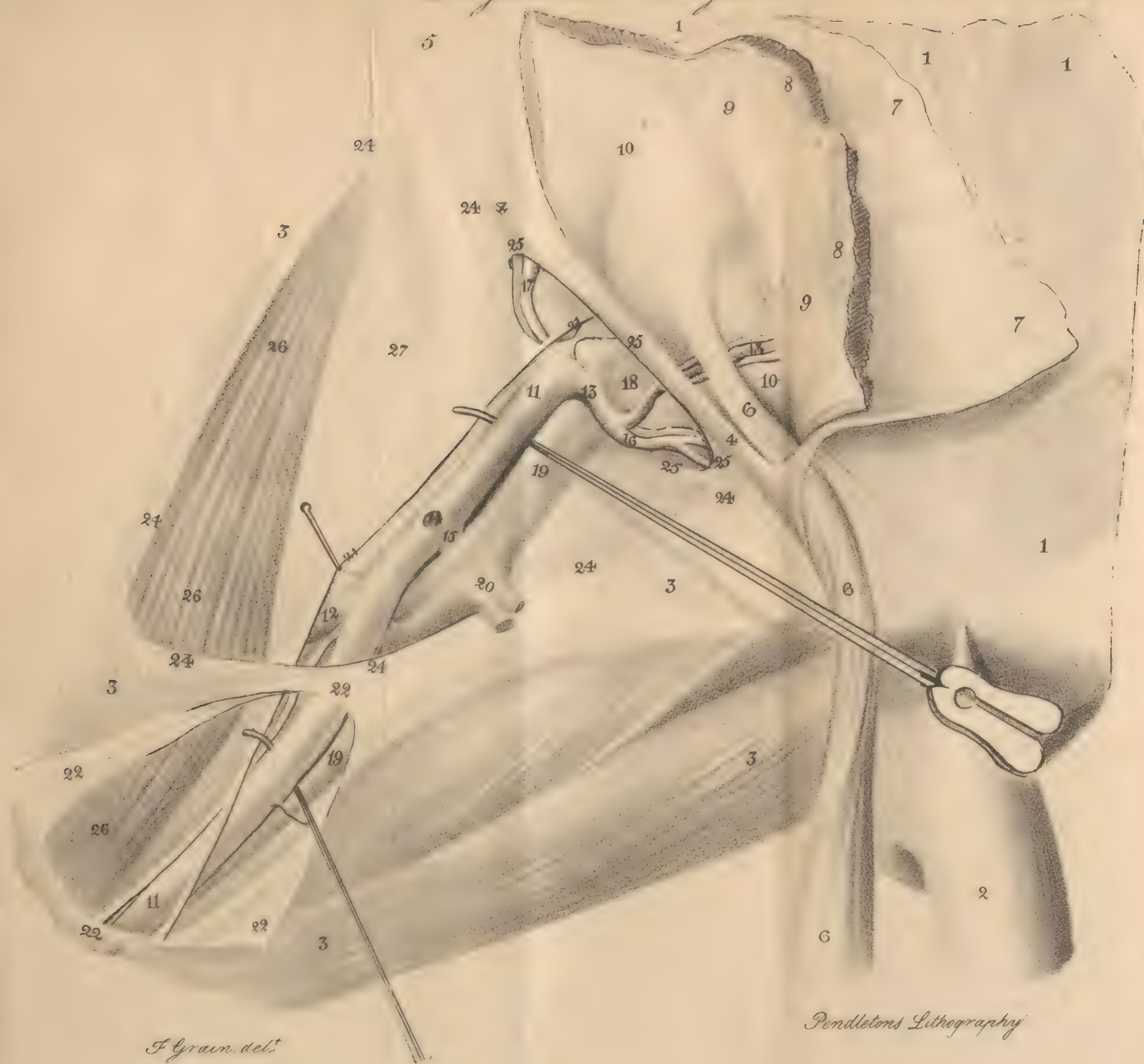


F. Guerin del.

Pondleton's Lithography

Inguinal Region.

PL. 8.



F. Gray. del.

Pendletons Lithography

View of the Sac Fossa and interior of the Pelvis.

PL. 9

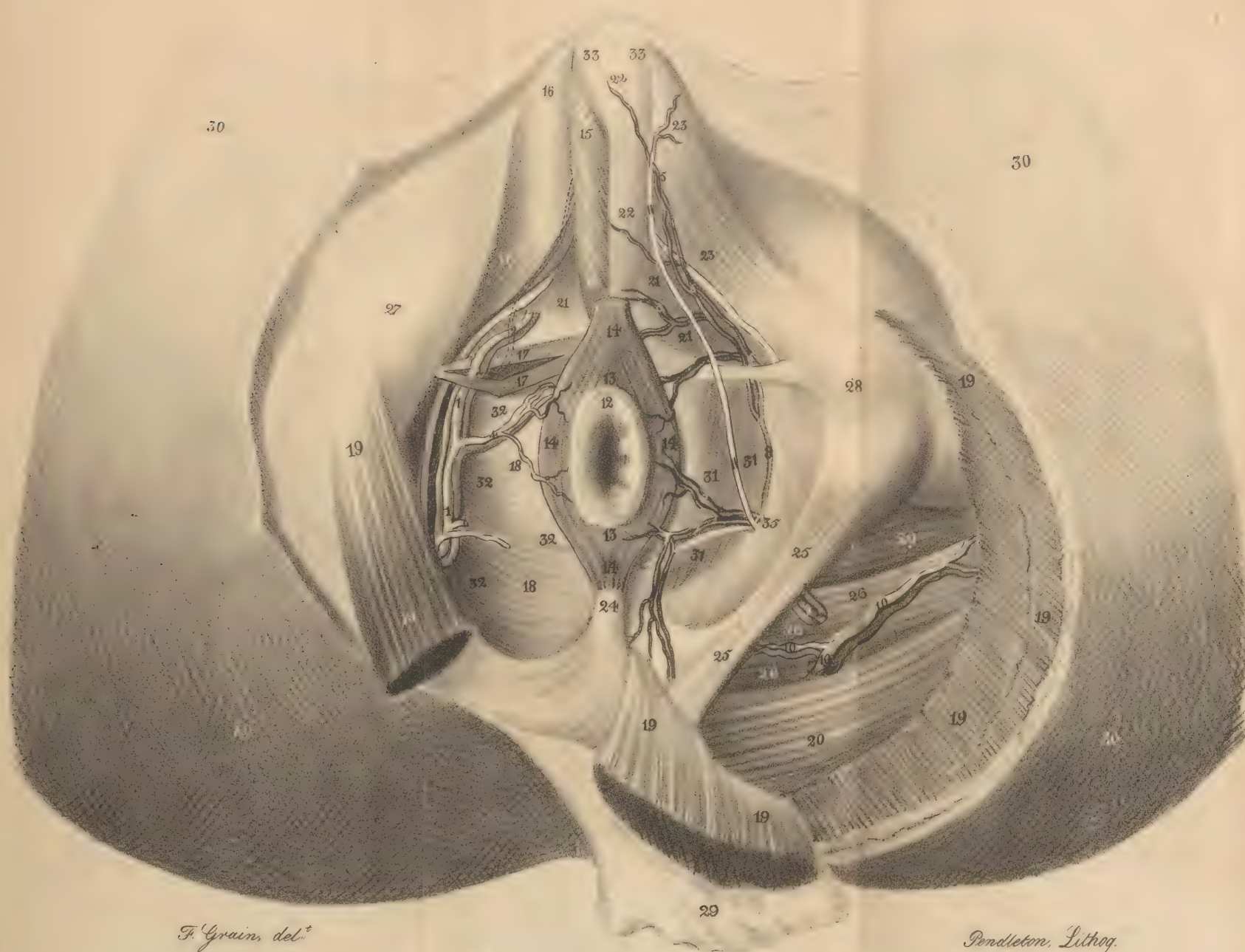


C. F. Graen, del.

(Pendletons Lithog.)

Anc-Perineal Region.

PL. 10

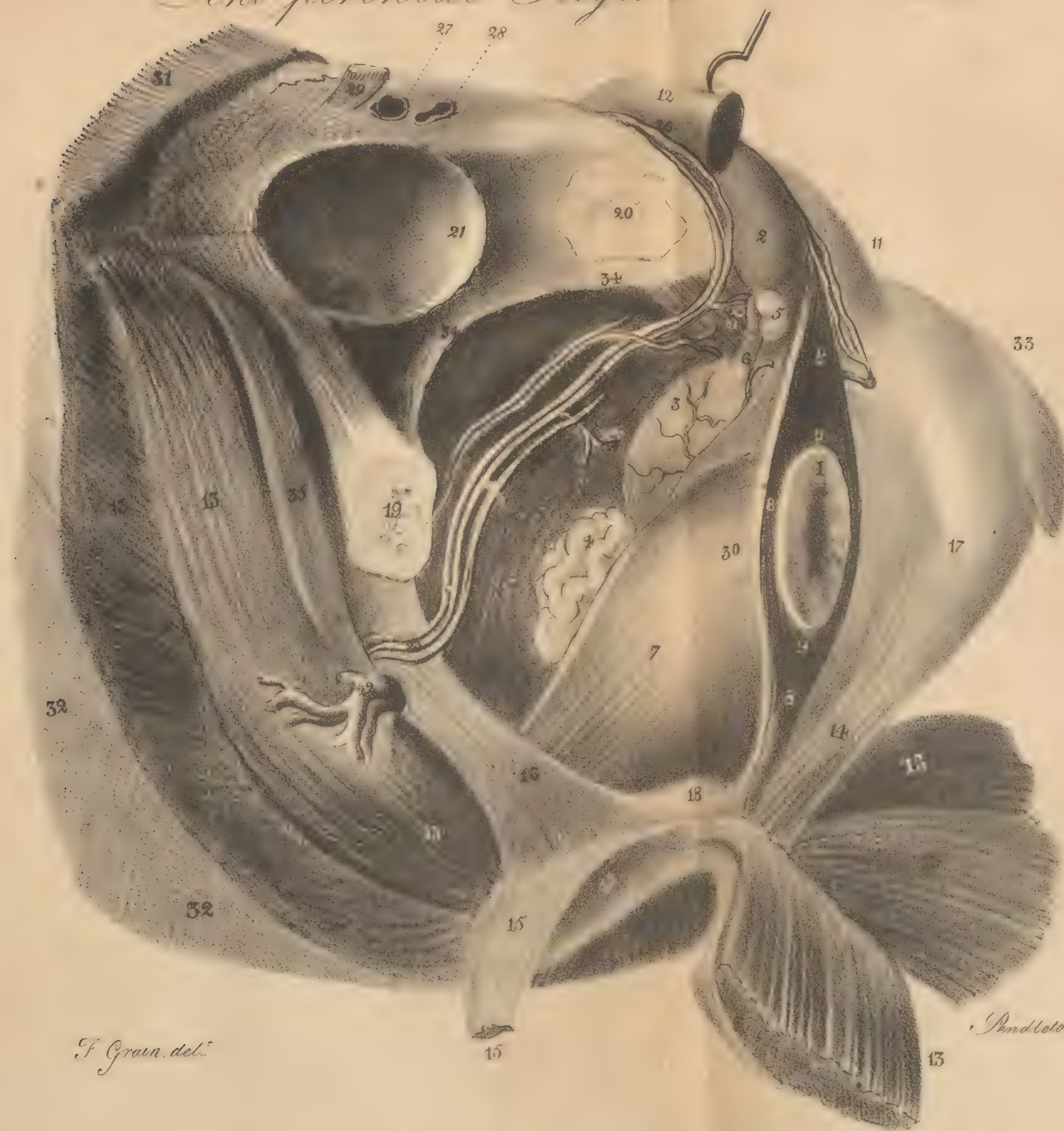


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Pondleton, Lithog.

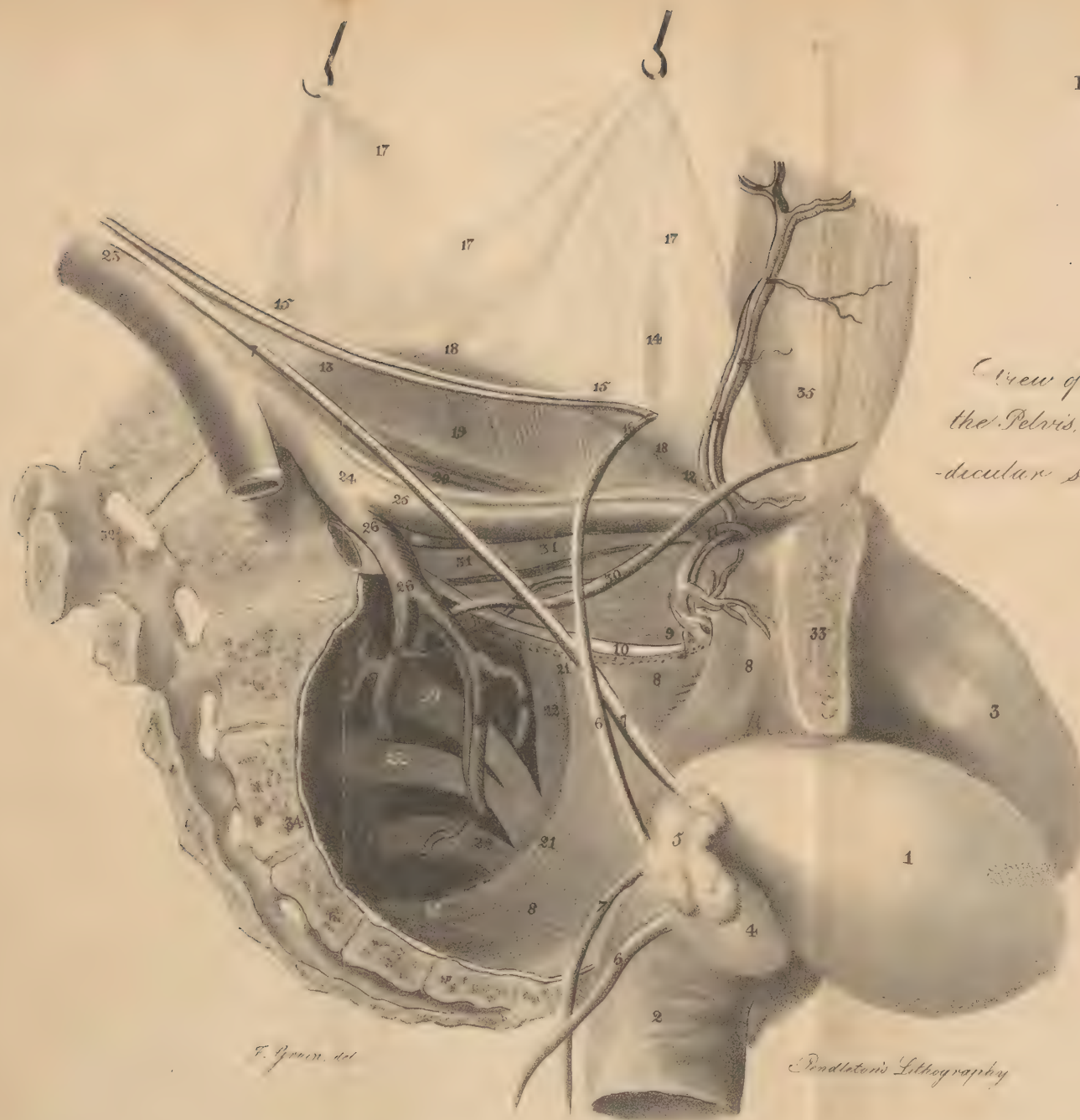
Ano-perineal Region

PL. 11



F. Gray, del.

And letons Lithography



*View of the interior of
the Pelvis, from a perpen-
-dicular section*

T. Gordon del

Pendleton's Lithography

*View of a vertical section of the Pelvis and of the genito-urinary organs,
relative to the operation of Lithotomy.*

PL. 13.

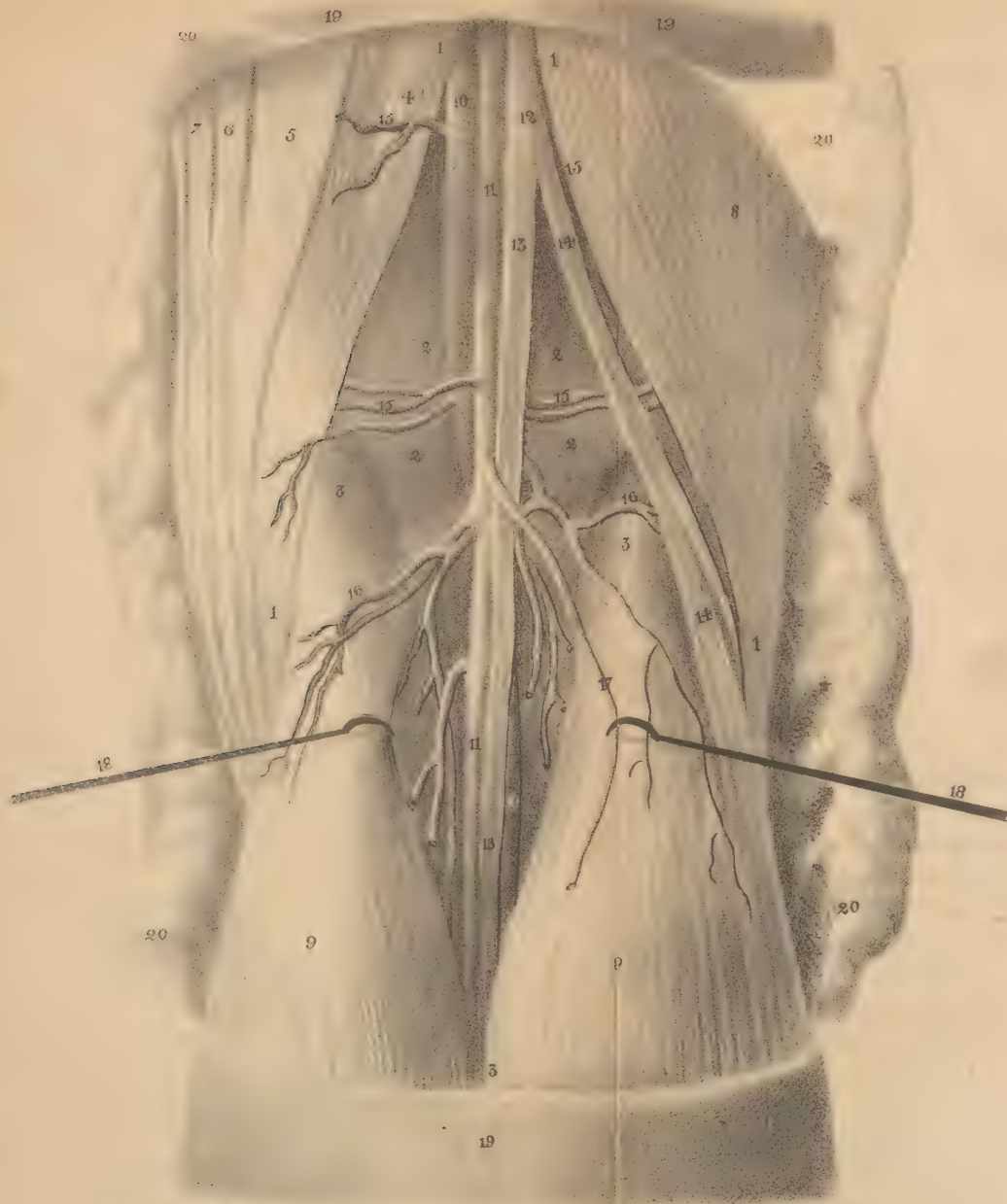


F. Grain, del.

Pendleton's Lithography.

Popliteal Region: C

PL 14.



F. Green, del

Pondlotons Lithography

APPENDIX.



As Mr. Velpeau, in his preface to this volume, has spoken in flattering terms of American Surgery, and has there, as well as in the body of his treatise, made mention of certain surgical operations which have had the effect of elevating the surgery of this country to a high summit of renown, whilst others of very considerable importance, some of which at least might lay claim to originality, have been passed over in silence, we have thought that it would not be unacceptable to enumerate the most prominent which have been successfully performed in the United States of America during the present century. By way of arrangement then we will begin with the

Extirpation of the Parotid Gland, an operation which was performed in February, 1826, by Dr. George McClellan, of Philadelphia. (*Vide American Medical Review and Journal for 1826.*)

Extirpation of Fungus from the Antrum Maxillare. For the following account of a new and very important operation for the removal of this disease we are indebted to Dr. Alexander H. Stevens:—

“On the 13th of August, 1823, Mr. ———, aged ——— years, consulted me (Dr. Stevens) on account of a swelling and a livid redness of the gum from the root of the first left incisor tooth to the penultimate molar of the upper jaw. The membrane lining the roof of the mouth between these two points, exhibited the same appearances. Externally, the cheek under the orbit of the eye

was projected forwards, so as to fill up the angle between the nose and cheek.

“Dr. Post was consulted on the case, and agreeing with me on the propriety of an operation, it was accordingly performed on the following day, in presence of Dr. Handy, Dr. Mott and Dr. Watts, and a numerous concourse of medical students, in the following manner:—

“The second incisor and the last molar tooth but one were first extracted. The commissure of the lips being then drawn up by an assistant, the upper lip was dissected from the os maxillare superius to within a line of the infra-orbital foramen. The bone (superior maxillary) was then bored through in this point by a long trocar, the point of which was carried backwards and downwards until it perforated the palatine membrane near the junction of the left os palati with the palatine process of the left os maxillare superius. The palatine membrane was then incised from this point to the exterior edge of the first left incisor tooth. The palatine process of the os maxillare superius was divided by a fine narrow saw, passed, with the teeth directed downwards and forwards, through the route made by the trocar.

“The soft parts covering the bone, both above and below, between the socket of the last molar tooth but one, and the perforations made of the trocar were next divided. It only remained to divide the bone. This was effected with great ease by a flexible elastic saw made of a clock spring, being about seven inches long and having teeth only in the middle, to the extent of three inches. It was introduced through the former division of bone from below upwards, one extremity passing out of the mouth, the other out of the superior opening made by the trocar. The two extremities of this saw were then connected to handles, so that it was worked with both hands, one pushing and the other pulling, alternately, so as to keep the saw bent laterally with its convexity backward until it completed the section of the bone in the direction of a curved line, extending from the point where the trocar first entered to the socket of the molar tooth extracted.

“The operation lasted about thirty minutes, being interrupted by the efforts made by the patient to free the fauces from the blood which flowed into them.

“The loss of blood was not more than twelve ounces.

“The examination of the removed jaw showed a fungous tumour occupying the whole antrum, and arising by a broad base from the lower portion of it.

“No bad symptom followed the operation: in four months the opening into the antrum was reduced to the size of one line in diameter, and in six months it was completely closed.

“An ingenious Dentist (Mr. Newton) fitted the teeth, as well those which were extirpated as those which were removed with the os maxillare, to an artificial jaw made of ivory, and the cavity in the cheek which followed the operation was restored to its natural appearance. The articulation and deglutition are also performed in so perfect a manner that only a few friends are aware of the nature of the operation to which he submitted.

“The patient, now, nearly seven years from the operation, enjoys perfect health.

“The superior advantages of this operative process over that of Desault and every other hitherto devised, will be readily appreciated by those who consider the ease and celerity with which a bone may be divided with a saw which circumscribes the diseased parts and compares it with that of gouges, chisels and mallets, by which they are irregularly broken, or the still more painful and uncertain operation of the actual cautery.”

In May, 1824, Dr. David L. Rogers of New York, performed an operation for osteo-sarcoma of the superior jaw, whereby he removed the superior maxillary bones anterior to the first molar tooth on each side, together with the two inferior turbinated bones, a part of the septum of the nostrils, the vomer and a portion of the antrum of the right side. (Vide N. Y. Med. and Phys. Journal, Vol. 3.)

Staphyloraphy was first performed in America by Dr. Alexander H. Stevens. (Vide North American Med. and Surg. Journal, Vol. 3.) The same operation has recently been repeated by Prof. Warren, of Boston. (See Amer. Journ. Med. Sciences for Nov. 1828.)

Lower Jaw.—Dr. Valentine Mott, of New York, first amputated this bone in this country. The operation was performed in November 1821. The carotid artery was previously secured.

and the right side of the under jaw was then removed at a very short distance below the bifurcation of its ascending branch; in another, which he performed on the 30th March, 1822, the anterior portion of this bone was excised. (See New York Med. and Phys. Journ. Vol. I.)

The same operation was repeated by Dr. John Wagner, of Charleston, S. C. in July, 1826; the left side of the inferior maxillary bone being removed by carrying the saw through its ascending branch below the sigmoid notch; and by Dr. J. Randolph, of Philadelphia, as far back as the last molar tooth (See N. Y. Med. and Phys. Journ. Vol. V. and American Journal Med. Sc. No. IX, for Nov. 1829.)

Clavicle. In June 1828, Professor Mott removed the Clavicle, the free movement of the arm being restored in September following. (See Amer. Journ. Med. Sc. for Nov. 1828.)

Shoulder Joint. In 1821, Prof. Stevens, having previously tied the Subclavian Artery, removed the arm at the shoulder joint. (See Amer. Edit. of Cooper's First Lines of Surgery, 1822.)

In June 1826, Dr. John Wagner of Charleston S. C. also amputated the arm at its superior articulation. (See N. Y. Med. and Phys. Journ. Vol. 5.)

In the first volume of the American Medical Recorder for 1818, we find a case related in which, in consequence of a gunshot wound, received in the battle on Lake Champlain, the head of the humerus was dissected out by Dr. Brown of the Navy, and soon afterwards the coracoid and acromion apophyses of the scapula, the humeral end of the clavicle, together with a superior projecting portion of the os humeri were removed from the same patient by Dr. Henry Hunt, of Washington.

Elbow Joint. In November 1825, Dr. J. Kearney Rodgers amputated the arm at the Elbow Joint; the adhesive union being effected in as favourable a manner as in those cases in which the amputation is made in the continuity of the bone. (See N. Y. Med. and Phys. Journal.)

Ulna. This bone has been successfully extirpated by Dr. Robert Butt of Virginia; the arm being afterwards restored to nearly its primitive usefulness and strength. (See Philadelphia Med. and Phys. Journ. for 1825.)

Extra Uterine Fœtus Extirpated. The late Dr. McKnight, of New York, about forty-five years ago, removed an extra-uterine fœtus from the abdomen of a woman in whom utero-gestation seemed to have gone on in a natural manner until after the expiration of the ordinary period. It would also appear from the narration of the case, as we find it recorded in Dr. Bard's *Compendium of the Theory and Practice of Midwifery*, that the operation must have been performed within a short time after the nine months from the supposed commencement of pregnancy had elapsed.

The incision, through which the fœtus was extracted, was commenced to the left of and a little above the umbilicus, rather external to the outer margin of the rectus, and carried down to the pubis, involving in its track the epigastric artery. In extricating the head of the fœtus, so much difficulty was experienced, that it became necessary to remove it by piece-meal; the rest of the body was brought away without mutilation; the placenta, on account of its adhesions, was allowed to remain.

This extra-uterine fœtus is in the possession of Dr. Delafield. The woman, now 80 years of age, recently presented herself to the examination of Dr. Stevens, who found a deficiency of the muscular parietes of the abdomen, between the rectus muscle and the left anterior superior spinous process of the ilium, causing a cavity large enough to admit four fingers.

For a more particular account of this operation see the work just cited, or the London Medical Essays, Vol. 4.

Ovarium Diseased and Enlarged. The first successful extirpation of this form of tumour was made by Dr. McDowell of Kentucky in December 1809. In April 1819 this operation was again repeated by the same gentleman. In July 1821, Dr. Nathan Smith, late Professor of Surgery &c. in Yale College, successfully extirpated an Enlarged Ovarium. Dr. Alban G. Smith, of Kentucky, was equally fortunate in a similar operation in May 1821; and we have been informed that Dr. David L. Rogers, of New York has quite recently been successful in a very formidable case of the same nature.

For an account of the four preceding we refer to the North American Med. and Surg. Journ. Vol. I. The latter will probably appear in the next No. of the N. Y. Med. and Phys. Journ.

Artificial Anus. In the second volume of the North American Med. and Surg. Journ. there is a very particular account of Dr. Physick's celebrated operation for the cure of Artificial Anus, as performed by him at the Pennsylvania Hospital in 1809, given by B. H. Coates, M. D.

Hip Joint. The first case in which amputation at the coxo-femoral articulation has been successful in this country, is that in which the operation was performed by Dr. Mott at the New-York Hospital in October 1824. (Vide Phil. Journ. Med. and Phys. Sc. Vol. 14, p. 101.)

In November 1826, Dr. J. Rhea Barton of Philadelphia sawed through the trochanter major and the adjoining portion of the cervix femoris in order to produce at this point an artificial joint, with the view of rendering useful a limb, which was rather worse than useless in consequence of the ankylosis of the thigh bone with the acetabulum. The result of the dexterous performance of this happy invention must have fully answered the author's most sanguine expectations. (See North Amer. Med. and Surg. Journ. Vol. 3, p. 279.)

Astragalus. This bone was removed by Dr. A. H. Stevens in 1826 in a case of Irreducible Compound Dislocation of the Ankle Joint. The mobility of the joint was restored and very little deformity or lameness resulted. (Vide Med. and Phys. Journ. Vol. 5.)

LIGATURE OF ARTERIES.

Brachio-Cephalic Artery (Arteria Innominata). In 1815 this vessel was tied by Professor Mott for an Aneurism of the Sub-clavian Artery, and, although not attended with complete success, the patient survived the operation twenty-six days. This case is recorded in the New York Hospital Register No. 2; and has been previously alluded to by M. Velpeau.

Common Carotid. The first successful operation, in the United States, for the obliteration of this artery, by ligature, was performed by the late Dr. Post at the New York Hospital on the 7th of January, 1813. (See American Med. and Philosoph. Register, Vol. 4, p. 336.)

The same operation has been frequently repeated in this country and, we believe, with constant success.

Subclavian Artery first successfully tied by Dr. Post in 1817.

Common Iliac. Professor Gibson of Baltimore was the first to execute the operation of tying this artery in America, but his patient died of peritoneal inflammation on or about the fifteenth day subsequent to it. (See Gibson's Surgery.) The only case on record (so far as we have been able to ascertain), in which an individual has perfectly recovered after the ligature of this vessel, was that in which it was performed by Dr. Mott, in March, 1827. (See North American Med. and Surg. Journal, Vol. 4, p. 179.)

External Iliac. This artery was first tied in these United States in 1811, by the late Dr. Dorsey of Philadelphia, and with complete success, (see Dorsey's Surgery,) and this operation has since then been repeatedly performed in the United States with results almost uniformly as favourable.

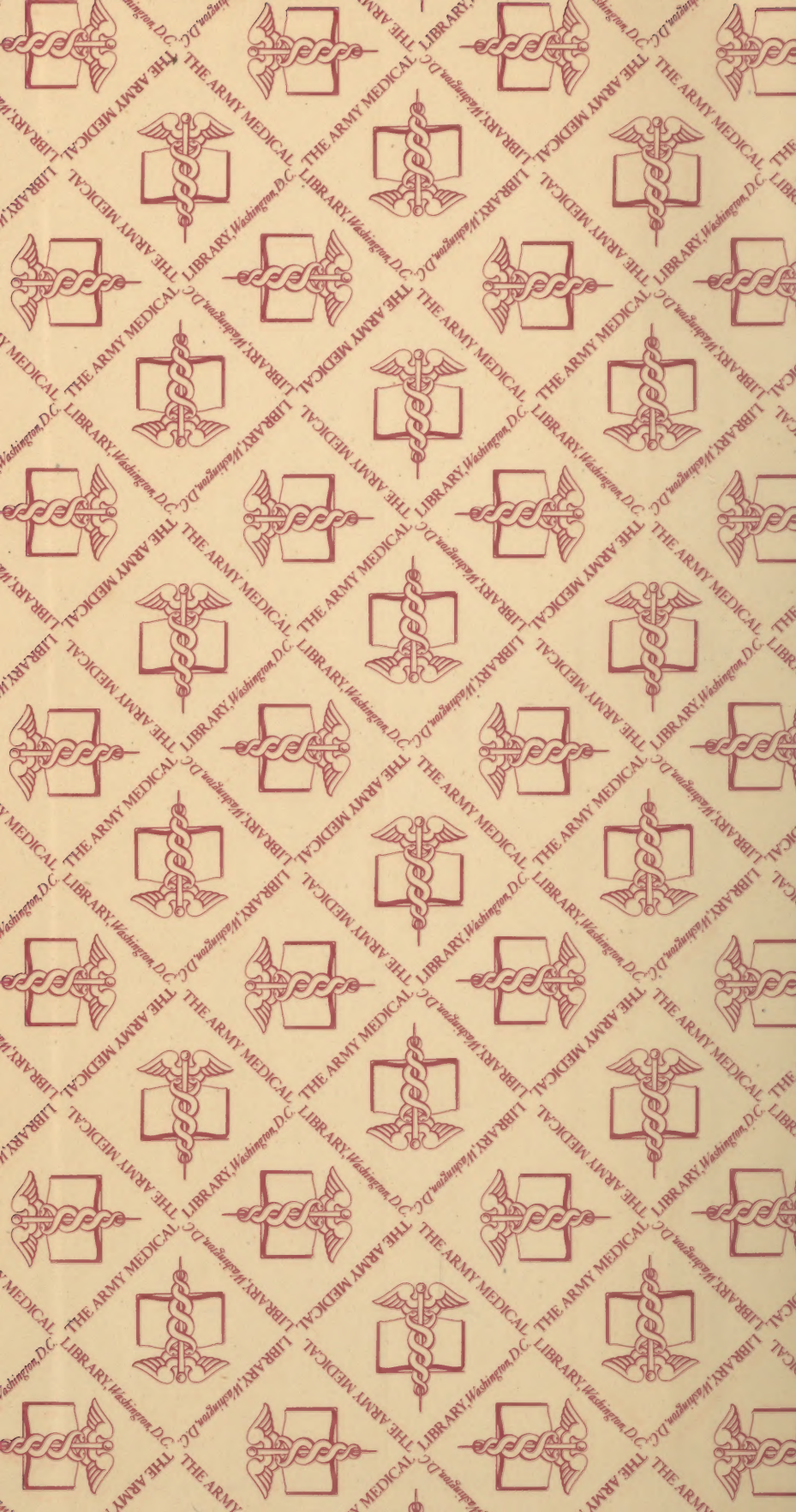
Internal Iliac Artery. The operation for securing this Artery, in a case of Gluteal Aneurism, was performed by Dr. S. Pomeroy White, of Hudson, New-York, in October, 1827, and his patient recovered. See North American Med. and Surg. Journal.

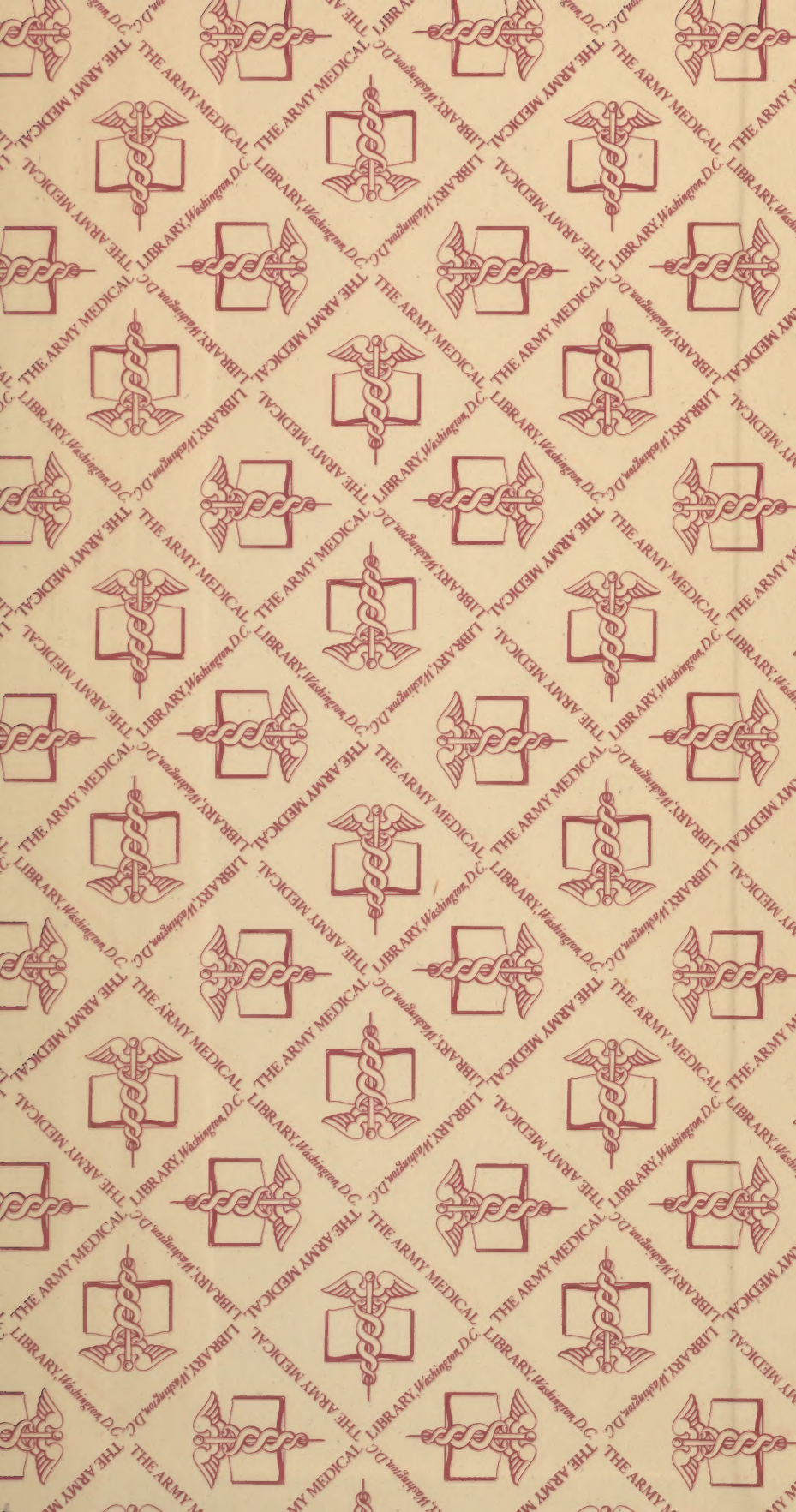
Thus have we, as far as a very limited period and opportunity have permitted, endeavoured to draw an Index of the most prominent operations which are scattered throughout the greater proportion of periodical and other medico-chirurgical publications which have issued from the American press during the present century, and we hope that it will at least have the good effect of enabling those, who hereafter may be induced to repeat them, to refer readily to the operative processes which have conducted to such successful results.

ERRATA.

Page 11, line 30th from the top, for "*transversed*" read *traversed*.

" 27,	5	" "	erase " <i>the layer</i> ."
" 54,	2	" "	for " <i>destitute in</i> ," read <i>destitute of</i> .
" 92,	2	" "	for " <i>hernia</i> ," read <i>herniæ</i> .
" 146, line the last,			for " <i>cicular</i> ," read <i>circular</i> .
" 172,	16 from the top,		for " <i>glans of the groin</i> ," read <i>glands of the groin</i> .
" 172,	19	" "	for " <i>glands and prepuce</i> ," read <i>glans and prepuce</i> .
" 187,	7	" "	for " <i>not to tie</i> ," read <i>not tie</i> .
" 188,	9	" "	for " <i>when the entire cord is tied</i> ," read <i>when tying the entire cord</i> .
" 192,	19	" "	for " <i>the divided extremity</i> ," read <i>the extremity</i> .
" 232,	4	" "	for " <i>less below than extensible above</i> ," read <i>less extensible below than above</i> .
" 257,	10	" "	for " <i>pelvic fascia pelvia</i> ," read <i>fascia pelvia</i> .
" 261,	last	" "	after " <i>sacro-vertebral</i> ," insert the word <i>angle</i> .
" 295,	6	" "	for " <i>below, concave</i> ," read <i>below, convex</i> ;
" 301,	17	" "	for " <i>present</i> ," read <i>presents</i> .
" 344,	31	" "	for " <i>turns</i> ," read <i>turn</i> .
" 350,	20	" "	for the note of interrogation, substitute a semicolon.
" 433,	26	" "	for " <i>one other</i> ," read <i>one another</i> .
" 490,	1	" "	for " <i>attribute these cause of the diseases</i> ," read <i>attribute the cause of these diseases</i> .
" 506,	last	" "	for " <i>sit</i> ," read <i>its</i> .





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